THE

MISSIONARY ARITHMETIC:

OR

ARITHMETIC MADE EASY,

IN A NEW METHOD:

DESIGNED TO

DIMINISH THE LABOR OF THE TEACHER,

AND

INCREASE THE IMPROVEMENT OF THE LEARNER.

ACCOMMODATED TO

THE PRESENT ERA OF BENEVOLENT ENTERPRIZE,

AND ADAPTED TO THE USE OF

LANCASTERIAN AND OTHER SCHOOLS.

BY WILLIAM R. WEEKS.

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PREFACE.

IN presenting to the public a new Arithmetic, the Author will doubtless be expected to offer some reasons for such a publication. He has been several years employed in the instruction of schools, and has found much inconvenience in teaching arithmetic from the books in common use, and much interruption to the other business of the school, from the study of it in the common way. The obscure manner in which the rules are usually expressed, and the want of sufficient illustration, render them extremely difficult to be comprehended by beginners. This discourages the learner from committing them to memory, and makes him impatient to go forward and attempt to perform the various questions which are inserted for practice in the rules. In doing this, he meets with many difficulties, owing to his ignorance of the rules, and is perpetually running to the instructor for assistance. The instructor must take time to work out his questions for him, or spend still more in giving explanations which are seldom remembered. And if he does not stop all the other business of the school, to attend thus to every learner, he is complained of for his neglect, and the learner is discouraged from attempting to comprehend what appears so dark and perplexing. None but those who have had experience in teaching schools, can appreciate the trouble, and vexation, and interruption, which continually arise from this source.

To furnish an Arithmetic, and to point out a mode of instruction, which shall remedy these evils, is the design of this work. The improvements attempted in it, are the following:

1. The rules are expressed in terms, and accompanied by explanations, more easy to be understood.

2. Under every rule, one question or more is performed at full length, and every step of the operation explained at large, that the meaning and application of the rule may be clearly seen.

3. Under the first rules, a number of examples, prepared in the Lancasterian manner, are given, for classes to be exercised in by the help of a monitor.

4. A large number of exercises are inserted, which consist of short and easy questions, with answers annexed, to be performed mentally, and answered extemporaneously, to a monitor; designed to quicken the attention of learners, and render all the usual operations in arithmetic perfectly familiar.

5. A set of questions are inserted, on the nature of each rule, without answers, in the manner of the modern improvements in teaching geography, that the scholar may examine the rule itself, and find out the answers: intended also for the use of classes.

6. The great mass of questions for the practice of learners, are expressed more in the form in which they will naturally arise in the transaction of business, and are set down by themselves in the second part of the work, without answers; and after a few of the first, they are not arranged in the order of the rules; so that the learner, in order to perform them, must understand his rules, and pay attention to the nature of the questions themselves. The number of them is also greater than usual, that the learner may have, in going through the book, abundant exercise in all the rules, and in all sorts of questions that will be likely to arise in the transactions of active life.

7. In forming the questions for practice, a large number of useful and interesting facts are embraced, which will not only serve the purpose of exercising the learner in the rules, but will convey to him much important information respecting the great enterprizes of Christian benevolence which distinguish the present age, and render this work a useful auxiliary, in training the rising generation to esteem the privilege, and practise the duty of doing good.

8. The rules for extracting the roots, are expressed in a new form, more easy to be understood and remembered.

9. Under the head of Mensuration, easy rules are given for finding the content of the various solids, the capacity of different vessels, the measurement of heights and distances, and the surveying of land, as far as is necessary for the common purposes of the farmer, without the aid of mathematical instruments.

10. The whole is adapted to the use of schools, in such a manner that all classes of learners may receive the requisite attention and instruction, with very little trouble to the instructor, and very little interruption to the other business of the school.

These improvements have been the result of several years' attention to the subject; and most of them have had the test of experience, in schools under the direction of the Author, long enough to demonstrate their utility.

For the valuable hints with which the Author has been obligingly furnished by various literary gentlemen, he would beg them to accept his thanks. He is particularly indebted to the Rev. Joseph Emerson, of the Byfield Seminary; Mr. Professor Strong, of Hamilton College; Mr. John Randel, Jun. of Albany, Surveyor; Mr. Luther Jackson, of New-York, Teacher; and the publications of Mr. Joseph Lancaster.

As some errors are almost inseparable from a first impression of a work of this nature, those who may discover any, will confer a favor on the Author, by transmitting to him, or to the publisher, a statement of them, that they may be corrected in a subsequent edition.

Paris, February, 1822.

ARITHMETIC MADE EASY.

PART I.

Arithmetic is the science of Numbers, and the art of using them.

Notation teaches how to express any number by the following characters, called figures; 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

Numeration teaches how to read, in the proper words, any number expressed by these figures.

When the figures stand one by one, their value is as follows: 1, one, 2, two, 3, three, 4, four, 5, five, 6, six, 7, seven, 8, eight, 9, nine, 0, nought; which is called their simple value. Besides their simple value, they have another, when two or more of them are joined together, which depends on the place in which they stand, and which may be called their local value.

The places are counted from right to left, as follows: first, units; second, tens; third, hundreds; fourth, thousands; fifth, tens of thousands; sixth, hundreds of thousands; seventh, millions; eighth, tens of millions; ninth, hundreds of millions: tenth, thousands of millions; and so on. Thus, 3, standing alone, is in the first place, and denotes three units, or three. With a cypher at the right hand of it, thus, 30, the 3, standing in the second place, denotes three tens, or thirty. With two cyphers, thus, 300, it stands in the third place, and denotes three hundred. With three cyphers, thus, 3000, it stands in the fourth place, and denotes three thousand. With four cyphers, thus, 30000, it stands in the fifth place, and denotes three tens of thousands, or thirty thousand. With five cyphers, thus, 300000, it stands in the sixth place, and denotes three hundreds of thousands, or three hundred thousand. With six cyphers, thus, 3000000, it stands in the seventh place, and denotes three millions. With seven cyphers, thus, 30000000, it stands in the eighth place, and denotes three tens of millions, or thirty millions. As in the following table:

Tens of mill.	Millions,	Hund. of th.	Tens of thou.	Thousands,	Hundreds,	Tens,	Units,	
							3	Three.
						3	0	Thirty.
					3	0	0	Three hundred.
				3	0	0	0	Three thousand.
			3	0	0	0	0	Thirty thousand.
		3	0	0	0	0	0	Three hundred thousand.
	3	0	0	0	0	0	0	Three millions.
3	0	0	0	0	0	0	0	Thirty millions.

From which it is plain, that every remove a figure makes from the right hand towards the left, increases its value tenfold; its value in the column of tens, being ten times as much as in the column of units; and in the column of hundreds, ten times as much as in the column of tens, and so on. The cypher has no value of its own, but only serves to show the local value of other figures to which it is annexed.

So also, when other figures are put in the places of these cyphers, each figure has a value according to the place in which it stands. Thus, in 21, the 1, standing in the first place, denotes 1 unit, or one, and the 2, standing in the second place, denotes 2 tens, or twenty; and taken together, they are to be read, twenty-one. In 321, the 1, standing in the first place, is one unit, or one; the 2, standing in the second place, is two tens, or twenty; and the 3, standing in the third place, is 3 hundreds, or three hundred; and taken together, they are to be read, three hundred and twenty one. See the following table:

Hund. of mill.	Tens of mill.	Millions,	Hund. of thou.	Tens of thou.	Thousands,	Hundreds,	Tens,	Units,	
								1	One.
							2	1	Twenty-one.
						3	2	1	Three hundred and twenty-one.
					4	3	2	1	Four thousand, three hundred & twenty-one.
				5	4	3	2	1	Fifty-four thousand, 3 hundred and 21.
			6	5	4	3	2	1	Six hundred & 54 thousand, 3 hund. & 21.
		7	6	5	4	3	2	1	Seven million, 654 thousand, 3 hund. & 21.
	8	7	6	5	4	3	2	1	Eighty-seven million, 654 thous. 321.
9	8	7	6	5	4	3	2	1	Nine hund. & 87 million, 6 hund. & 54 thous. 321.

QUESTIONS ON THE FOREGOING.

What is Arithmetic?
What does Notation teach?
What does Numeration teach?
What is meant by the simple value of any figure?
What by its local value?
Where do you begin to count the places of figures, in Numeration?
What is the name of the first place? the second? third? fourth? fifth? sixth? seventh? eighth? ninth? tenth?
What is the value of the figure 3, standing in the third place, with cyphers at the right hand of it?
What, in the second place? the fifth? fourth? eighth? seventh? sixth?
How much does a figure increase its value, by every remove from right to left?
How do you read the figures 1, 2, 3, 4, when placed so that 1 shall stand in the first place, 2 in the second, 3 in the third, and 4 in the fourth?
How do you read the figures, 1. 2, 3, 4, 5, 6, standing 1 in the first place, 2 in the second, and so on?
How, the figures, 1, 2, 3, 4 5, 6, 7, after the same arrangement?
How do you read the same figures, when 7 stands in the first place, 6 in the second, 5 in the third, and so on?

Note. To use the following exercise, let the class be seated with their slates, but without any books. Let the Monitor take a book, and read the words, *twenty-one*; and let every boy write down, at the top of his slate, the figures which express that number. Then let the Monitor examine all the slates, and if any one has not written it right, show him how to do it. Then let him read the words *thirty-two*, and let them write it as before; and so on, placing the numbers under each other, as they stand in the table, units under units, tens under tens, &c. When the slates are filled, let them read their figures in words, the first boy reading the first number, and the second the next, and so on; the Monitor looking over the words in the table, to see if they read them right.

Exercise 1.

21 Twenty-one.
32 Thirty-two.
524 Five hundred and twenty-four.
78 Seventy-eight.
169 One hundred and sixty-nine.
436 Four hundred and thirty-six.
1234 One thousand, two hundred and thirty-four.
3451 Three thousand, four hundred and fifty-one.
89 Eighty-nine.
643 Six hundred and forty-three.
4326 Four thousand, three hundred and twenty-six.
235 Two hundred and thirty-five.
6478 Six thousand, four hundred and seventy-eight.
21564 Twenty-one thousand, five hundred & sixty-four.
987 Nine hundred and eighty-seven.
99 Ninety-nine.
34567 Thirty-four thousand, five hundred and 67.
2348673 Two million, 348 thousand, 6 hundred and 73.
6542 Six thousand, five hundred and forty-two.
129834 One hundred and 29 thousand, 8 hundred and 34.

Note. When the class are sufficiently practised in this exercise, let them take exercises 2 and 3. After they have had a little practice in them, let questions be given from all promiscuously. And let no boy proceed to the next rule, till he is thoroughly acquainted with all that goes before, and can write down correctly, from the mouth of the Instructor, any number he shall dictate, and read correctly any number he shall write.

Exercise 2.

12 Twelve.
201 Two hundred and one.
2020 Two thousand and twenty.
2200 Two thousand, two hundred.
2002 Two thousand and two.
30303 Thirty thousand, three hundred and three.
303030 Three hundred and three thousand and thirty.
330303 Three hundred & 30 thousand, 3 hundred & 3.
3033003 Three million, thirty-three thousand and three.
31091 Thirty one thousand and ninety one.
404040 Four hundred and four thousand and forty.
4014 Four thousand and fourteen.
4004041 Four million, four thousand and forty-one.
15115 Fifteen thousand, one hundred and fifteen.
50505 Fifty thousand, five hundred and five.
6606060 Six million, six hundred and 6 thousand and 60.
60006 Sixty thousand and six.
9901019 Nine million, nine hundred and 1 thousand and 19.
109090 One hundred and nine thousand and ninety.
770071 Seven hundred and seventy thousand and 71.

Exercise 3.

101 One hundred and one.
110 One hundred and ten.
1001 One thousand and one.
1010 One thousand and ten.
1100 One thousand, one hundred.
1011 One thousand and eleven.
11001 Eleven thousand and one.
10100 Ten thousand, one hundred.
10010 Ten thousand and ten.
100001 One hundred thousand and one.
101100 One hundred and one thousand, one hundred.
11010 Eleven thousand and ten.
10011 Ten thousand and eleven.
100101 One hundred thousand, one hundred and one.
11011 Eleven thousand and eleven.
10111 Ten thousand, one hundred and eleven.

101011 One hundred and one thousand and eleven.
11101 Eleven thousand, one hundred and one.
1100001 One million, one hundred thousand and one.
1101101 One million, one hundred and one thousand, 101.

EXPLANATION OF CHARACTERS.

= Two parallel horizontal lines signify equality, as 100 cents = 1 dol. that is, 100 cents *equal* 1 dollar.

\+ A cross, made by a horizontal line and another perpendicular to it, is the sign of addition, as 2+4=6, that is, the sum of 2 and 4, is equal to 6.

— A horizontal line, is the sign of subtraction, and shows that the number which stands after it is to be taken from the number which stands before it, as 6—2=4, that is, 6 *diminished by* 2, is equal to 4.

× A cross, like the Roman letter X, is the sign of multiplication, as 3×6=18, that is 3 *times* 6 is equal to 18.

÷ A horizontal line, with a point above and below it, is the sign of division, and shows that the number which stands before it is to be divided by that which stands after it, as 24÷6=4, that is, 24 *divided by* 6, is equal to 4.

: : : : Points standing one above another like colons, are used to signify proportion. That is, when four numbers are placed in succession, with one colon between the first and second, two colons between the second and third, and one colon between the third and fourth, they signify that the first number has the same proportion to the second, that the third has to the fourth; thus, 2 : 4 :: 8 : 16, that is, as 2 is to 4, so is 8 to 16.

·· Two points, standing beside each other, are used in this work to separate different denominations; as, £2 ·· 6 ·· 8. that is, 2 pounds, 6 shillings, and 8 pence.

· A single point is used in decimal fractions, to separate the whole numbers from the decimal parts, as 8·5, that is 8 and 5 tenths. It is also used to separate dollars from cents and mills, because cents and mills are decimal parts of a dollar; as, $3·657, that is, 3 dollars, 65 cents and 7 mills.

½ One number written over another, with a line between, is called a vulgar fraction; as ½ one half, ⅓ one third, ¾ three fourths.

Note well. The learner should be careful not to make any of these marks upon his slate or paper, for any other purpose, or with any other meaning, than is here directed; and to make no unnecessary marks whatever.

QUESTIONS ON THE FOREGOING.

What is the sign of equality? of addition? subtraction? multiplication? division? proportion?
What marks are used to separate different denominations?
For what is a single point used?
Why is it used for the latter?
How are vulgar fractions written?
What caution should the learner observe about marks?

FUNDAMENTAL RULES.

There are four rules which are called the Fundamental Rules, because all operations in arithmetic are performed by the use of them. They are Addition, Subtraction, Multiplication, and Division.

ADDITION,

Is putting together two or more numbers, so as to find their total amount, which is called their sum.

It is called Simple Addition, when the numbers to be put together are all of the same denomination.

RULE.

1. Write down the several numbers under each other, so that units shall stand under units, tens under tens, &c.

2. Draw a line under the lowest number, to separate the given numbers from their sum, when it shall be found.

3. Take the right hand column, or row of units, begin at the bottom, and add up. If the sum of that column is less than ten, that is, if it is but one figure, it is units, and you must set it down under the column of units, and proceed to the next column. If it is ten or more, that is, if it is more than one figure, set down the right hand figure, which is a unit, under the column of units, and carry the rest, which will be tens, and add them to the column of tens.

4. Add up the column of tens, and when you have found the sum, if it is but one figure, it is tens, and you must set it down under the column of tens; but if it is more than one figure, the right hand one is tens, and must be set down under the column of tens, and the rest will be hundreds, and must be carried and added to the column of hundreds.

5. Proceed in like manner through all the columns to the last, where you must set down the whole amount of that column.

PROOF.

Begin at the top, and add downwards, and if the total is the same as the first total, the work is probably right.

EXAMPLE.

Find the sum of 321, 436, 372, and 647.

First, I write down the numbers under each other, so that units stand under units, tens under tens, &c.; then I draw a line under, and add as follows:

321
436
372
647
—
1776

I begin at the right hand column, at the bottom, and say, 7 and 2 is 9, and 6 is 15, and 1 is 16. The right hand figure 6, being units, I set down under the column of units; and the other 1, being a ten, I carry to the column of tens, and say, 1 to 4 is 5, and 7 is 12, and 3 is 15, and 2 is 17. This being the sum of the column of tens, is 17 tens, or one hundred and seventy. The right hand figure 7, being tens, and denoting 7 tens or 70, I set down under the column of tens, and carry the other 1, being a hundred, to the column of hundreds, and say, 1 to 6 is 7, and 3 is 10, and 4 is 14, and 3 is 17. This being the sum of the column of hundreds, is 17 hundreds, or one thousand seven hundred. The 7, denoting seven hundreds, I set down under the column of hundreds; and the 1, denoting one thousand, I set down in the place of thousands, there being no column of thousands to which to carry it. And the answer is, *one thousand, seven hundred and seventy-six.*

PROOF.

321
436
372
647
—
1776

I begin at the right hand column at the top, and say, 1 and 6 is 7, and 2 is 9, and 7 is 16. Set down 6 under the 7, and carry 1 to the next column. 1 and 2 is 3, and 3 is 6, and 7 is 13, and 4 is 17. Set down 7 under the 4, and carry 1 to the next. 1 and 3 is 4, and 4 is 8, and 3 is 11, and 6 is 17. Set down 17. And the total is 1776, the same as before; so I conclude the work is right.

Note. To use the following example, let a class be seated with their slates, and let the Monitor take the book and read the first number, and let it be taken down and examined. Then let him read the second number, and see that that is taken down correctly, and placed under the first, so that units shall stand under units, tens under tens, &c. When all the numbers are correctly taken down, and a line drawn under, let him read the work as it is set down under the question, repeating it slowly and distinctly. While he reads, let each boy follow him up the column, pointing to each figure as the monitor names it, and taking notice of the amount which it makes; and when the Monitor tells what figure to set down at the bottom of the column, let each boy set it down; and so on, till the whole is finished. And when

the Monitor reads the amount, let each boy read it after him, from his slate. When this is done, let that work be rubbed out, and another example performed in the same manner. When all the examples have been several times repeated in this way, let the Monitor vary the process, in this manner: let him name the first and second figures, and instead of reading from his book what they amount to, let the first boy tell, then let the Monitor repeat the amount, and name the next figure, and the second boy tell the amount, and so on, till the whole is finished. If one boy tells wrong, let it be put to the next, and if no one can tell right, let the Monitor tell.

No. 1.

27935
3963
8679
1437
———
54904

Work. Take the right hand column, and begin at the bottom. 7 and 9 is 16, and 3 is 19, and 5 is 24; set down 4 under the 7, and carry 2 to the next.

Second column. 2 and 2 is 4, and 7 is 11, and 6 is 17, and 3 is 20; set down 0 under the 2, and carry 2 to the next.

Third column. 2 and 3 is 5, and 6 is 11, and 9 is 20, and 9 is 29; set down 9 under the 3, and carry 2 to the next.

Fourth column. 2 and 4 is 6, and 8 is 14, and 3 is 17, and 7 is 24; set down 4 under the 4, and carry 2 to the next.

Fifth column. 2 and [illegible] is 3, and 2 is 5; set down 5.

Total, in figures, 54904; in words, fifty-four thousand, nine hundred and four.

No. 2.

12345
6789
32356
7890
13456
7891
2845
———
83072

Work, first column. 5 and 1 is 6, and 6 is 12, and 6 is 18, and 9 is 27, and 5 is 32; set down 2, and carry 3.

Second column. 3 and 4 is 7, and 9 is 16, and 5 is 21, and 9 is 30, and 5 is 35, and 8 is 43, and 4 is 47; set down 7, and carry 4.

Third column. 4 and 3 is 7, and 8 is 15, and 4 is 19, and 8 is 27, and 3 is 30, and 7 is 37, and 3 is 40; set down 0, and carry 4.

Fourth column. 4 and 2 is 6, and 7 is 13, and 3 is 16, and 7 is 23, and 2 is 25, and 6 is 31, and 2 is 33; set down 3, and carry 3.

Fifth column. 3 and 1 is 4, and 3 is 7, and 1 is 8; set down 8.

Total, in figures, 83072; in words, eighty-three thousand, and seventy-two.

No. 3.

56784
90235
45676
81237
45988
76549
32131
45802
72343
56784
92345
———
695874

Work; first column. 5 and 4 is 9, and 3 is 12, and 2 is 14, and 1 is 15, and 9 is 24, and 8 is 32, and 7 is 39, and 6 is 45, and 5 is 50, and 4 is 54; set down 4, and carry 5.

Second column. 5 and 4 is 9, and 8 is 17, and 4 is 21, and 3 is 24, and 4 is 28, and 8 is 36, and 3 is 39, and 7 is 46, and 3 is 49, and 8 is 57; set down 7, and carry 5.

Third column. 5 and 3 is 8, and 7 is 15, and 3 is 18, and 8 is 26, and 1 is 27, and 5 is 32, and 9 is 41, and 2 is 43, and 6 is 49, and 2 is 51, and 7 is 58; set down 8, and carry 5.

Fourth column. 5 and 2 is 7, and 6 is 13, and 2 is 15, and 5 is 20, and 2 is 22, and 6 is 28, and 5 is 33, and 1 is 34, and 5 is 39, and 6 is 45; set down 5, and carry 4.

Fifth column. 4 and 9 is 13, and 5 is 18, and 7 is 25, and 4 is 29, and 3 is 32, and 7 is 39, and 4 is 43, and 8 is 51, and 4 is 55, and 9 is 64, and 5 is 69; set down 69.

Total, in figures, 695874; in words, six hundred and ninety-five thousand, eight hundred and seventy-four.

No. 4.

5678
9123
4567
2198
3456
1987
2345
9876
8765
1203
2044
———
51242

Work; first column. 4 and 3 is 7, and 5 is 12, and 6 is 18, and 5 is 23, and 7 is 30, and 6 is 36, and 8 is 44, and 7 is 51, and 3 is 54, and 8 is 62; set down 2, and carry 6.

Second column. 6 and 4 is 10, and 6 is 16, and 7 is 23, and 4 is 27, and 8 is 35, and 5 is 40, and 9 is 49, and 6 is 55, and 2 is 57, and 7 is 64; set down 4, and carry 6.

Third column. 6 and 2 is 8, and 7 is 15, and 8 is 23, and 3 is 26, and 9 is 35, and 4 is 39, and 1 is 40, and 5 is 45, and 1 is 46, and 6 is 52; set down 2, and carry 5.

Fourth column. 5 and 2 is 7, and 1 is 8, and 8 is 16, and 9 is 25, and 2 is 27, and 1 is 28, and 3 is 31, and 2 is 33, and 4 is 37, and 9 is 46, and 5 is 51; set down 51.

Total, in figures, 51242; in words, fifty-one thousand, two hundred and forty-two.

No. 5.

3456
7890
128
907
4017
8969
798
1476
5079
8986
754
9023
805
998
1676
2007
6789
——
63758

Work; first column. 9 and 7 is 16, and 6 is 22, and 8 is 30, and 5 is 35, and 3 is 38, and 4 is 42, and 6 is 48, and 9 is 57, and 6 is 63, and 8 is 71, and 9 is 80, and 7 is 87, and 7 is 94, and 8 is 102, and 6 is 108; set down 8, and carry 10.

Second column. 10 and 8 is 18, and 7 is 25, and 9 is 34, and 2 is 36, and 5 is 41, and 8 is 49, and 7 is 56, and 7 is 63, and 9 is 72, and 6 is 78, and 1 is 79, and 2 is 81, and 9 is 90, and 5 is 95; set down 5, and carry 9.

Third column. 9 and 7 is 16, and 6 is 22, and 9 is 31, and 8 is 39, and 7 is 46, and 9 is 55, and 4 is 59, and 7 is 66, and 9 is 75, and 9 is 84, and 1 is 85, and 8 is 93, and 4 is 97; set down 7, and carry 9.

Fourth column. 9 and 6 is 15, and 2 is 17, and 1 is 18, and 9 is 27, and 8 is 35, and 5 is 40, and 1 is 41, and 8 is 49, and 4 is 53, and 7 is 60, and 3 is 63; set down 63.

Total, in figures, 63758; in words, sixty-three thousand, seven hundred and fifty-eight.

Questions.

1. The number of ordained missionaries among the heathen in the year 1821, was as follows: From England, 235; Scotland, 7; United States, 39; Denmark, 2; Moravians, (different countries,) 68: how many in all? *Ans.* 351.

2. In the year 1820, the American Board of Commissioners for Foreign Missions, had the following missionaries and assistants among the heathen, to wit: In Eastern Asia, 25; Western Asia, 2; Sandwich Islands, 17; American Indians, 44: how many in all? *Ans.* 88.

3. The disbursements from the treasury, for expenses, during the same year, were as follows: For the Bombay mission, 7221 dollars; Ceylon, 7135; Cherokee, 9967; Choctaw, 10414; Arkansaw, 1150; Indian missions generally, 252; Palestine, 2348; Foreign mission school, 3350; Sandwich island, 10330; travelling expenses of members of the Board, &c. 457; salary of Secretary, 500; salary of Treasurer, 600; clerk hire, postage and stationary, 1142; printing, 1558; agents to collect funds, 261; expenses of meetings, 84; transportation of articles, 107; bad bills, 184; other contingencies, 84: how much in all? *Ans.* 57144 dollars.

Note. For further questions to exercise the learner, see Part II.; and he should proceed to perform some of them immediately.

Questions on the foregoing.

What are the fundamental rules of Arithmetic?
Why are they so called?
What is addition?
When is it called simple addition?
What is to be observed in writing down the numbers to be added?
Which column do you add first?
Where do you begin to add?
When you have added up the column of units, what do you do with the amount, if it is one figure?
What, if it is more than one?
When you have added up the column of tens, and the amount of it is two figures, what is the value of the right hand figure?
What of the other?
What do you do with them?
When the amount of the column of hundreds is two figures, what is the value of each?
What do you do with them?
When you have added up the last column, what do you do with the amount?
How do you prove addition?

Note. To use the following exercise, let a class be seated without slates or books, and answer extemporaneously. Let the monitor take the book, and ask, what is the sum of 5 and 7? and look at the column of answers, and see that the boy answers right. If he answers wrong, let him put it to the next, but if right, let him put another question to the next, as, what is the sum of 8 and 6? carefully observing not to put the questions in succession as they stand, lest one answer should suggest the next. When a class have been sufficiently exercised in this way of which the instructor will judge, let the monitor vary the questions, thus, 7 from 12, how many remains? 6 from 14, how many remains? and so on. When one exercise of this kind has been attended to, till most of the class can answer the questions correctly, let the next exercise be taken and used in the same manner. And if there is reason to think, at any time, that the boys have committed them to memory, let the monitor be directed to make one of his numbers larger or smaller, and observe that the answer will be as much larger or smaller; or, let the instructor prepare new exercises of a similar kind, for his monitors to make use of; that the boys may be compelled to perform the operation in their minds, before they can answer correctly. *It will greatly facilitate the improvement of learners, for them to have abundant exercise in this way. Perhaps fifteen or twenty minutes, twice a day, would not be too much.*

Exercise 4.

2 + 1 = 3	2 + 11 = 13	3 + 9 = 12	4 + 7 = 11
2 + 2 = 4	2 + 12 = 14	3 + 10 = 13	4 + 8 = 12
2 + 3 = 5	3 + 1 = 4	3 + 11 = 14	4 + 9 = 13
2 + 4 = 6	3 + 2 = 5	3 + 12 = 15	4 + 10 = 14
2 + 5 = 7	3 + 3 = 6	4 + 1 = 5	4 + 11 = 15
2 + 6 = 8	3 + 4 = 7	4 + 2 = 6	4 + 12 = 16
2 + 7 = 9	3 + 5 = 8	4 + 3 = 7	5 + 1 = 6
2 + 8 = 10	3 + 6 = 9	4 + 4 = 8	5 + 2 = 7
2 + 9 = 11	3 + 7 = 10	4 + 5 = 9	5 + 3 = 8
2 + 10 = 12	3 + 8 = 11	4 + 6 = 10	5 + 4 = 9

5 and 5 is 10
5 and 6 is 11
5 and 7 is 12
5 and 8 is 13
5 and 9 is 14
5 and 10 is 15
5 and 11 is 16
5 and 12 is 17
6 and 1 is 7
6 and 2 is 8
6 and 3 is 9
6 and 4 is 10
6 and 5 is 11
6 and 6 is 12
6 and 7 is 13
6 and 8 is 14
6 and 9 is 15
6 and 10 is 16
6 and 11 is 17
6 and 12 is 18
7 and 1 is 8
7 and 2 is 9
7 and 3 is 10
7 and 4 is 11
7 and 5 is 12
7 and 6 is 13
7 and 7 is 14
7 and 8 is 15
7 and 9 is 16
7 and 10 is 17
7 and 11 is 18
7 and 12 is 19
8 and 1 is 9
8 and 2 is 10
8 and 3 is 11
8 and 4 is 12
8 and 5 is 13
8 and 6 is 14
8 and 7 is 15
8 and 8 is 16
8 and 9 is 17
8 and 10 is 18

8 and 11 is 19
8 and 12 is 20
9 and 1 is 10
9 and 2 is 11
9 and 3 is 12
9 and 4 is 13
9 and 5 is 14
9 and 6 is 15
9 and 7 is 16
9 and 8 is 17
9 and 9 is 18
9 and 10 is 19
9 and 11 is 20
9 and 12 is 21
11 and 2 is 13
11 and 3 is 14
11 and 4 is 15
11 and 5 is 16
11 and 6 is 17
11 and 7 is 18
11 and 8 is 19
11 and 9 is 20
11 and 10 is 21
11 and 12 is 23
12 and 2 is 14
12 and 3 is 15
12 and 4 is 16
12 and 5 is 17
12 and 6 is 18
12 and 7 is 19
12 and 8 is 20
12 and 9 is 21
12 and 10 is 22
12 and 11 is 23
12 and 12 is 24
13 and 2 is 15
13 and 3 is 16
13 and 4 is 17
13 and 5 is 18
13 and 6 is 19
13 and 7 is 20
13 and 8 is 21

13 and 9 is 22
13 and 10 is 23
13 and 11 is 24
13 and 12 is 25
14 and 2 is 16
14 and 3 is 17
14 and 4 is 18
14 and 5 is 19
14 and 6 is 20
14 and 7 is 21
14 and 8 is 22
14 and 9 is 23
14 and 10 is 24
14 and 11 is 25
14 and 12 is 26
15 and 2 is 17
15 and 3 is 18
15 and 4 is 19
15 and 5 is 20
15 and 6 is 21
15 and 7 is 22
15 and 8 is 23
15 and 9 is 24
15 and 10 is 25
15 and 11 is 26
15 and 12 is 27
16 and 2 is 18
16 and 3 is 19
16 and 4 is 20
16 and 5 is 21
16 and 6 is 22
16 and 7 is 23
16 and 8 is 24
16 and 9 is 25
16 and 10 is 26
16 and 11 is 27
16 and 12 is 28
17 and 2 is 19
17 and 3 is 20
17 and 4 is 21
17 and 5 is 22
17 and 6 is 23

17 + 7 = 24
17 " 8 " 25
17 " 9 " 26
17 " 10 " 27
17 " 11 " 28
17 " 12 " 29
18 " 2 " 20
18 " 3 " 21
18 " 4 " 22
18 " 5 " 23
18 " 6 " 24
18 " 7 " 25
18 " 8 " 26
18 " 9 " 27
18 " 10 " 28
18 " 11 " 29
18 " 12 " 30
19 " 2 " 21
19 " 3 " 22
19 " 4 " 23
19 " 5 " 24
19 " 6 " 25
19 " 7 " 26
19 " 8 " 27
19 " 9 " 28
19 " 10 " 29
19 " 11 " 30
19 " 12 " 31
22 " 8 " 30
22 " 9 " 31
22 " 10 " 32
22 " 11 " 33
22 " 12 " 34
23 " 8 " 31
23 " 9 " 32
23 " 10 " 33
23 " 11 " 34
23 " 12 " 35
24 " 9 " 33
24 " 10 " 34
24 " 11 " 35
24 " 12 " 36

25 and 7 is 32
25 and 8 is 33
25 and 9 is 34
25 and 10 is 35
25 and 11 is 36
25 and 12 is 37
26 and 6 is 32
26 and 7 is 33
26 and 8 is 34
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26 and 11 is 37
26 and 12 is 38
27 and 6 is 33
27 and 7 is 34
27 and 8 is 35
27 and 9 is 36
27 and 10 is 37
27 and 11 is 38
27 and 12 is 39
28 and 5 is 33
28 and 6 is 34
28 and 7 is 35
28 and 8 is 36
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28 and 11 is 39
28 and 12 is 40
29 and 6 is 35
29 and 7 is 36
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29 and 11 is 40
29 and 12 is 41
32 and 7 is 39
32 and 8 is 40
32 and 9 is 41
32 and 11 is 43
32 and 12 is 44
33 and 6 is 39
33 and 7 is 40
33 and 8 is 41
33 and 9 is 42
33 and 11 is 44
33 and 12 is 45
34 and 7 is 41
34 and 8 is 42
34 and 9 is 43
34 and 11 is 45
34 and 12 is 46
35 and 7 is 42
35 and 8 is 43
35 and 9 is 44
35 and 11 is 46
35 and 12 is 47
36 and 7 is 43
36 and 8 is 44
36 and 9 is 45
36 and 11 is 47
36 and 12 is 48
37 and 7 is 44
37 and 8 is 45
37 and 9 is 46

37 and 11 is 48
37 and 12 is 49
38 and 7 is 45
38 and 8 is 46
38 and 9 is 47
38 and 11 is 49
38 and 12 is 50
39 and 8 is 47
39 and 9 is 48
39 and 11 is 50
39 and 12 is 51
42 and 8 is 50
42 and 9 is 51
42 and 11 is 53
42 and 12 is 54
43 and 8 is 51
43 and 9 is 52
43 and 11 is 54
43 and 12 is 55
44 and 8 is 52
44 and 9 is 53
44 and 11 is 55
44 and 12 is 56
45 and 8 is 53
45 and 9 is 54
45 and 11 is 56
45 and 12 is 57
46 and 8 is 54
46 and 9 is 55
46 and 11 is 57
46 and 12 is 58

47 + 8 = 55
47 " 9 " 56
47 " 11 " 58
47 " 12 " 59
48 " 8 " 56
48 " 9 " 57
48 " 11 " 59
48 " 12 " 60
49 " 8 " 57
49 " 9 " 58
49 " 11 " 60
49 " 12 " 61
53 " 8 " 61
53 " 9 " 62
53 " 11 " 64
53 " 12 " 65
54 " 7 " 61
54 " 8 " 62
54 " 9 " 63
54 " 11 " 65
54 " 12 " 66
55 " 7 " 62
55 " 8 " 63
55 " 9 " 64
55 " 11 " 66
55 " 12 " 67
64 " 9 " 73
75 " 11 " 86
86 " 12 " 98
74 " 9 " 83
87 " 6 " 93

Exercise 5.

Tell the sum of

3	+	5	+	2	*Ans.*	10	6	+	7	+	3	*Ans.*	16	3	+	10	+	12	*Ans.*	25
10		6		3		19	8		6		5		19	3		9		7		19
4		7		2		13	7		5		4		16	4		11		6		21
5		8		3		16	9		4		6		19	4		9		3		16
7		4		9		20	5		3		7		15	5		8		7		20
8		9		4		21	3		2		8		13	6		9		2		17
4		8		2		14	3		5		8		16	7		5		4		16

EXERCISE 6

Tell the sum of

9+	2+	7	*Ans.* 18	5+	7+	9	*Ans.* 21	5+	7+	12	*Ans.* 24
8	3	12	23	2	12	9	23	6	7	11	24
2	11	3	16	2	6	11	19	6	8	12	26
7	4	6	17	3	11	4	18	7	5	8	20
3	9	5	17	4	7	11	22	7	6	12	25
6	7	4	17	4	9	12	25	8	11	5	24
4	6	11	21	5	6	11	22	8	12	3	23

SUBTRACTION,

Is taking a less number from a greater, so as to find their difference, which is called the remainder.

It is called Simple Subtraction, when the numbers are of one denomination.

RULE.

1. Write the less number under the greater, in such a manner that units shall stand under units, tens under tens, &c. and draw a line under.

2. Begin at the right hand, and take the lower figure from that above it, and set down the remainder underneath; and so on, with all the rest.

3. But if the lower figure is greater than that above it, borrow 10 and add to the upper figure, and then subtract the lower, and set down the remainder.

4. And where you borrow 10 to add to the upper figure, in one column, carry or add 1 to the lower figure of the next column.

Note. The reason why 1 is carried while 10 is borrowed, is, that 1 in the column of tens is equal to 10 in the column of units. And if 10 is added to the upper line in the column of units, and 1 is added to the lower line in the column of tens, an equal amount is added to each line. But if the same amount is added to each line, their difference will remain the same. Thus, the difference between 8 and 6 is 2; and if you add 10 to each, they will be 18 and 16, and their difference will still be 2.

EXAMPLE.

Find the difference between 3456 and 1238.

3456
1238
2218

Here, I first set down 3456, the greater number, and then under it, 1238, the less; so that units stand under units, &c. Then I begin at the right hand, and say, 8 from 6 I cannot; borrow 10, and add to the 6, and it makes 16; 8 from 16 leaves 8; set down 8. Having added 10 to the column of units in the upper line, I must add as much to the lower, and so I carry 1 to the column

of tens, and say, 1 to 3 is 4, and 4 from 5 leaves 1; set down 1, and proceed to the next column. 2 from 4 leaves 2; set down 2, and proceed to the next. 1 from 3 leaves 2; set down 2. And the remainder, thus found, is 2218.

PROOF.

Add the remainder to the less number, and if the work is right, their sum will equal the greater number.

Note. The following examples are to be performed by a class with a monitor, as those in addition.

No. 1.

From 2345
Take 1452
Rem. 893

Work. Begin at the right hand at the bottom, and say, 2 from 5 leaves 3; set down 3. *Second column.* 5 from 4 I cannot; borrow 10, which added to the 4 is 14; 5 from 14 leaves 9; set down 9. *Third column.* For the 10 that I borrowed in the last column, carry 1 to this; 1 and 4 is 5; 5 from 3 I cannot; borrow 10, and say, 5 from 13 leaves 8; set down 8. *Fourth column.* Carry 1 to 1 is 2; 2 from 2 leaves 0.

Remainder, in figures, 893; in words, eight hundred and ninety-three.

No. 2.

From 98764
Take 34985
Rem. 63779

Work. 5 from 4 I cannot; borrow 10, and 5 from 14 leaves 9; set down 9. 1 carried to 8 is 9; 9 from 6 I cannot; borrow 10, and 9 from 16 leaves 7; set down 7. 1 carried to 9 is 10; 10 from 7 I cannot; borrow 10, and 10 from 17 leaves 7; set down 7. 1 carried to 4 is 5; 5 from 8 leaves 3; set down 3. 3 from 9 leaves 6; set down 6.

Remainder, in figures, 63779; in words, sixty-three thousand, seven hundred and seventy-nine.

No. 3.

From 91234
Take 51301
Rem. 39933

Work. 1 from 4 leaves 3; set down 3. 0 from 3 leaves 3; set down 3. 3 from 2 I cannot; borrow 10, and 3 from 12 leaves 9; set down 9. 1 carried to 1 is 2, 2 from 1 I cannot; borrow 10, and 2 from 11 leaves 9; set down 9. 1 carried to 5 is 6; 6 from 9 leaves 3; set down 3.

Remainder, in figures, 39933; in words, thirty-nine thousand, nine hundred and thirty-three.

No. 4.

From 9876543
Take 987654
Rem. 8888889

Work. 4 from 3 I cannot, but 4 from 13 leaves 9. 1 to 5 is 6; 6 from 4 I cannot, but 6 from 14 leaves 8. 1 to 6 is 7; 7 from 5 I cannot, but 7 from 15 leaves 8. 1 to 7 is 8; 8 from 6 I cannot, but 8 from 16 leaves 8. 1 to 8 is 9; 9 from 7 I cannot, but 9 from 17 leaves 8. 1 to 9 is 10; 10 from 8 I cannot, but 10 from 18 leaves 8. 1 to 0 is 1; 1 from 9 leaves 8. *Remainder*, 8888889.

QUESTIONS.

1. If the population of the world is 820000000, and the number of nominal christians is 214000000, how many are destitute of the gospel? *Ans.* 606000000.

2. Our Lord and Saviour, previous to his ascension, in the year 33, commanded his disciples to preach the gospel among all nations, and the London Missionary Society was formed in the year 1795; how long between? *Ans.* 1762 *years.*

3. The canon of scripture was completed in the year 97, and the British and Foreign Bible Society was formed in the year 1804; how long between? *Ans.* 1707 *years.*

QUESTIONS ON THE FOREGOING.

What is Subtraction?
When is it called Simple Subtraction?
How many numbers are employed?
How must they be written down?
Where do you begin?
What is to be done if the upper figure is less than the lower?
When you have borrowed 10, how many must you carry, and where?
Why is 1 carried, while 10 was borrowed?
How is subtraction proved?

EXERCISE 7.

From	Take	Ans.	From	Take	Ans.	From	Take	Ans.
12,	3+4,	5	11,	4+3+2,	2	20,	6+5+3,	6
15,	4 7,	4	17,	5 3 4,	5	18,	9 3 4,	2
18,	9 6,	3	19,	7 2 3,	7	19,	4 5 7,	3
20,	7 12,	1	21,	9 6 3,	3	17,	5 1 4,	7
25,	9 12,	4	16,	4 3 7,	2	16,	4 3 6,	3
14,	3 5,	6	23,	5 3 4,	11	15,	1 2 3,	9
12,	1+2+6,	3	24,	6 9 3,	6	19,	2 4 7,	6

MULTIPLICATION,

Is a short way of performing addition, and teaches how to find the amount of a number when added to itself a certain number of times.

It is called Simple Multiplication, when the number to be multiplied is of one denomination.

The number to be multiplied is called the *multiplicand;* the number to multiply by, is called the *multiplier;* and the number found, or total amount, is called the *product.*

The multiplicand and multiplier are both called *factors.*

Note. Before proceeding to any operations in multiplication, it is necessary to learn perfectly the following table.

MULTIPLICATION TABLE.

2 times	4 times	6 times	8 times	10 times	12 times
2 is 4	2 is 8	2 is 12	2 is 16	2 is 20	2 is 24
3 is 6	3 is 12	3 is 18	3 is 24	3 is 30	3 is 36
4 is 8	4 is 16	4 is 24	4 is 32	4 is 40	4 is 48
5 is 10	5 is 20	5 is 30	5 is 40	5 is 50	5 is 60
6 is 12	6 is 24	6 is 36	6 is 48	6 is 60	6 is 72
7 is 14	7 is 28	7 is 42	7 is 56	7 is 70	7 is 84
8 is 16	8 is 32	8 is 48	8 is 64	8 is 80	8 is 96
9 is 18	9 is 36	9 is 54	9 is 72	9 is 90	9 is 108
10 is 20	10 is 40	10 is 60	10 is 80	10 is 100	10 is 120
11 is 22	11 is 44	11 is 66	11 is 88	11 is 110	11 is 132
12 is 24	12 is 48	12 is 72	12 is 96	12 is 120	12 is 144
3 times	5 times	7 times	9 times	11 times	
2 is 6	2 is 10	2 is 14	2 is 18	2 is 22	
3 is 9	3 is 15	3 is 21	3 is 27	3 is 33	
4 is 12	4 is 20	4 is 28	4 is 36	4 is 44	
5 is 15	5 is 25	5 is 35	5 is 45	5 is 55	
6 is 18	6 is 30	6 is 42	6 is 54	6 is 66	
7 is 21	7 is 35	7 is 49	7 is 63	7 is 77	
8 is 24	8 is 40	8 is 56	8 is 72	8 is 88	
9 is 27	9 is 45	9 is 63	9 is 81	9 is 99	
10 is 30	10 is 50	10 is 70	10 is 90	10 is 110	
11 is 33	11 is 55	11 is 77	11 is 99	11 is 121	
12 is 36	12 is 60	12 is 84	12 is 108	12 is 132	

CASE I.

To multiply any given number by a single figure, or by any number not over 12.

RULE.

1. Set down the multiplier under the units figure, or right hand place of the multiplicand, and draw a line underneath.

2. Begin at the right hand figure, and multiply. If the product of the units figure of the multiplicand is but one figure, set it down in the place of units. If it is more figures than one, set down the right hand figure, or units, and carry the rest to be added to the product of the tens.

3. Multiply the tens, and to the product add what was carried from the product of the units. Set down the right hand figure, and carry the rest to be added to the product of the hundreds. And so on, to the end, setting down the whole in the last place.

Note. To prevent mistakes, it will be well to make a minute of what is to be carried each time.

Example 1.

Multiply 5678
By 4
Prod. 22712

Work. 4 times 8 is 32; set down 2, and carry 3. 4 times 7 is 28, and 3 I carried is 31; set down 1, and carry 3. 4 times 6 is 24, and 3 I carried is 27; set down 7 and carry 2. 4 times 5 is 20, and 2 I carried is 22; set down 22. *Product*, in figures, 22712; in words, twenty-two thousand seven hundred and twelve.

Note. Observe, that I do not carry the tens of the product of the units to the tens of the multiplicand, before I multiply them, but to their product; the reason of which will appear, by varying the process, as follows:

5678
4
32
280
2400
20000
22712

Here, 4 times 8 is 32, 4 times 70 is 280, 4 times 600 is 2400, and 4 times 5000 is 20000, which added together, is 22712, as before. From which it appears, that the carrying is only done in the addition of the several products together.

Example 2.

Multiply 34567
By 7
Prod. 241969

Work. 7 times 7 is 49: set down 9, and carry 4. 7 times 6 is 42, and 4 I carried, is 46; set down 6, and carry 4. 7 times 5 is 35, and 4 I carried, is 39; set down 9, and carry 3. 7 times 4 is 28, and 3 I carried, is 31; set down 1, and carry 3. 7 times 3 is 21, and 3 I carried, is 24; set down 24. *Prod.* 241969.

Example 3.

Multiply 9876
By 12
Prod. 118512

Work. 12 times 6 is 72; set down 2, and carry 7. 12 times 7 is 84, and 7 I carried is 91; set down 1, and carry 9. 12 times 8 is 96, and 9 I carried, is 105; set down 5, and carry 10. 12 times 9 is 108, and 10 I carried is 118; set down 118. *Prod.* 118512.

Case II.

To multiply by a number consisting of several figures.

Rule.

1. Set down the multiplier under the multiplicand, so that units shall stand under units, tens under tens, &c. and draw a line underneath.

2. Multiply the whole of the multiplicand by the first or units figure of the multiplier, and set down the product, as in case first.

3. Multiply the whole of the multiplicand by the second figure of the multiplier, and set down the product in the same manner, only placing each figure of the product one remove to the left.

4. Multiply in the same manner by the third figure of the multiplier, and place the figures of the product two removes to the left. And so on, to the end, placing the figures of each product so that the first shall always stand under the figure by which you are multiplying.

5. When you have multiplied by all the figures of the multiplier, add the several products together, and their sum will be the answer, or whole product required.

Example 1.

Multiply 3456
By 325
17280
6912
10368
Prod. 1123200

Work. First figure. 5 times 6 is 30; set down 0, and carry 3. 5 times 5 is 25, and 3 I carried, is 28; set down 8, and carry 2. 5 times 4 is 20, and 2 I carried is 22; set down 2, and carry 2. 5 times 3 is 15, and 2 I carried, is 17; set down 17.

Second figure. 2 times 6 is 12; set down 2 under the 2, and carry 1. 2 times 5 is 10, and 1 I carried is 11; set down 1, and carry 1. 2 times 4 is 8, and 1 I carried is 9; set down 9. 2 times 3 is 6; set down 6.

Third figure. 3 times 6 is 18; set down 8 under the 3, and carry 1. 3 times 5 is 15, and 1 I carried is 16; set down 6, and carry 1. 3 times 4 is 12, and 1 I carried, is 13; set down 3, and carry 1. 3 times 3 is 9, and 1 I carried is 10; set down 10.

Having obtained the product of the multiplicand by each figure of the multiplier, those products are now to be added. Draw a line under and add.

First column. 0 is 0; set down 0. *Second column.* 2 and 8 is 10: set down 0, and carry 1. *Third column.* 1 carried to 8 is 9, and 1 is 10, and 2 is 12; set down 2, and carry 1. *Fourth column.* 1 carried to 6 is 7, and 9 is 16, and 7 is 23; set down 3, and carry 2. *Fifth column.* 2 carried to 3 is 5, and 6 is 11, and 1 is 12; set down 2, and carry 1. *Sixth column.* 1 carried to 0 is 1; set down 1. *Seventh column.* 1 is 1; set down 1. *Total Prod.* 1123200.

Note. The reason for placing the first figure of the second product one remove to the left, or in the place of tens, is, that it is the product of the units of the multiplicand by the tens of the multiplier, and is therefore tens, and should be put in the place of tens. For the same reason, the first figure of of the third product is hundreds, and of the fourth thousands, and so on. Accordingly, in the above example, 17280 is the product of 3456 by 5. But 6912, with the 2 standing in the place of tens, is the same as 69120, and is the product of 3456 by 20. And 10368, with the 8 stand in the place of hundreds, is the same as 1036800, and is the product of 3456 by 300.

Example 2.

Multiply	98765	*Work. First figure.* 8 times 5 is 40;
By	678	set down 0 under the 8, and carry 4.
		8 times 6 is 48, and 4 I carried, is 52;
	790120	set down 2 and carry 5. 8 times 7 is
	691355	56, and 5 I carried, is 61; set down 1,
	592590	and carry 6. 8 times 8 is 64, and 6 I
		carried, is 70; set down 0 and carry 7.
Prod.	66962670	8 times 9 is 72, and 7 I carried, is 79;
		set down 79.

Second figure. 7 times 5 is 35; set down 5, under the 7, and carry 3. 7 times 6 is 42, and 3 I carried, is 45; set down 5, and carry 4. 7 times 7 is 49, and 4 I carried is 53; set down 3, and carry 5. 7 times 8 is 56, and 5 I carried, is 61; set down 1, and carry 6. 7 times 9 is 63, and 6 I carried, is 69; set down 69.

Third figure. 6 times 5 is 30; set down 0, under the 6, and carry 3. 6 times 6 is 36, and 3 I carried, is 39; set down 9, and carry 3. 6 times 7 is 42, and 3 I carried, is 45; set down 5, and carry 4. 6 times 8 is 48, and 4 I carried, is 52; set down 2, and carry 5. 6 times 9 is 54, and 5 I carried, is 59; set down 59.

Next, draw a line under and add. 0 is 0; set down 0. 5 and 2 is 7; set down 7. 5 and 1 is 6; set down 6. 9 and 3 is 12; set down 2, and carry 1. 1 to 5 is 6, and 1 is 7, and 9 is 16; set down 6, and carry 1. 1 to 2 is 3, and 9 is 12, and 7 is 19; set down 9, and carry 1. 1 to 9 is 10, and 6 is 16; set down 6, and carry 1. 1 to 5 is 6; set down 6.

Total product, 66962670.

Case. III.

When there are cyphers at the right hand of one or both the factors, or between the other figures of the multiplier.

Rule.

1. If the cyphers are at the right hand of the numbers, multiply the other figures as in case 1 or 2, and annex to the product as many cyphers as were neglected.

2. If cyphers are between other figures in the multiplier, neglect them also, only take care to place the first figure of every product exactly under its multiplier.

Example.

Multiply 304050
By 20300

91215000
60810

Prod. 6172215000

Work. Neglect the three cyphers at the right hand of the factors, and begin with 3 and 5. 3 times 5 is 15; set down 5, under the 3, annexing three cyphers to it, and carry 1. 3 times 0 is 0, and 1 I carried, is 1; set down 1. 3 times 4 is 12; set down 2, and carry 1. 3 times 0 is 0, and 1 I carried, is 1; set down 1. 3 times 3 is 9. The next figure of the multiplier being a cypher, neglect that, and take 2. 2 times 5 is 10; set down 0, under 2, and carry 1. 2 times 0 is 0, and 1 I carried is 1; set down 1. 2 times 4 is 8; set down 8. 2 times 0 is 0; set down 0. 2 times 3 is 6; set down 6.

Next, draw a line under, and add. 0 is 0; set down 0. 0 is 0; set down 0. 0 is 0; set down 0. 5 is 5; set down 5. 1 is 1; set down 1. 0 and 2 is 2; set down 2. 1 and 1 is 2; set down 2. 8 and 9 is 17; set down 7, and carry 1. 1 to 0 is 1; set down 1. 6 is 6; set down 6. *Total product,* 6172215000.

Note. The reason for annexing to the product theyc phers which had been neglected at the right hand of the factors, is, that in the above example, the product of the first significant figures is not really the product of 5 by 3, but of 50 by 300, which is not 15, but 15000. And the reason for setting the first figure of the product of 5 by 2 in the place of hundreds of thousands, is, that it is not really the product of 5 by 2, but of 50 by 20000, which is not 10, but 1000000.

Proof.

First method. Multiply the multiplier by the multiplicand, and the product will be the same as before, if the work is right.

Exnmple. Take the first example under Case I. and invert the factors.

Multiply	4
By	5678
	32
	28
	24
	20
Prod.	22712

Work. 8 times 4 is 32; set down 31. 7 times 4 is 28; set down 28, so that the 8 shall stand under the 7. 6 times 4 is 24; set down 24, so that the 4 shall stand under the 6. 5 times 4 is 20; set down 20, so that the 0 shall stand under the 5. Next, add, 2 is 2; set down 2. 8 and 3 is 11; set down 1, and carry 1. 1 to 4 is 5, and 2 is 7; set down 7. 0 and 2 is 2; set down 2. 2 is 2; set down 2. *Total product,* 22712, which is the same as before; so I conclude the work is right.

Second method. Divide the product by the multiplier, and the quotient will be equal to the multiplicand, if the work is right. This is the method usually practised by experienced arithmeticians, as the safest; but as the learner is not supposed to be as yet acquainted with division, let him prove his work by the first method, or let him make use of the

Third method. 1. Cast the 9's out of both the factors, and place the remainders at the opposite ends of a dotted line. 2. Multiply those remainders together, cast the 9's out of their product, and set down the remainder above the dotted line. 3. Cast the 9's out of the product you wish to prove, and set down the remainder under the dotted line. If the work is right, the figures above and below the dotted line will be alike.

Example.	*Proof.*
Multiply 34562	1
By 5	*Md.* 2 . . . . . 5 *Mr.*
Product, 172810	1
	Prod.

Explanation. I first take the multiplicand, and say, 3 and 4 is 7, and 5 is 12; cast away 9, and 3 remains. 3 and 6 is 9; cast it away. 2 is left, as the remainder of the multiplicand, which I set down at the left hand of the dotted line. I then take the multiplier, which being but 5, there is no 9 to cast away; so I set down 5 at the right hand of the dotted line, as the remainder of the multiplier.

2. I multiply these two remainders together, saying 2 times 5 is 10; cast away 9, and 1 remains, which I set down above the dotted line.

3 I take the product, and say, 1 and 7 is 8, and 2 is 10; cast away 9, and 1 remains. 1 and 8 is 9; cast it away. 1 and 0 is 1, which being less than 9, I set it down under the dotted line, as the remainder of the product.

And the figures above and below the dotted line being alike, I conclude the work is right.

Note. This method of proof is not infallible, because the right figures may stand in the product, and not stand in the right order; or two wrong figures may amount to the same, when added together, as the two right ones would. But as this method will usually detect a mistake, and is shorter than the other methods, it is thought useful to be retained.

Questions.

1. If a child eats 6 cents worth of fruit, nuts, &c. every week, how many cents could he save in a year, being 52 weeks, and give for the education of heathen children, by denying himself those indulgencies? *Ans.* 312.

2. If a child should employ his play hours in working for the education of heathen children, and should earn 3 cents a day, by so doing, how many cents would he earn in a year for that purpose, there being 313 working days? *Ans.* 939.

3. If the population of the United States is 9630000, and every person should earn or save 3 cents a day for doing good, how many cents would that be in a year? *Ans.* 9042570000.

Questions on the foregoing.

What is multiplication?
When is it called simple multiplication?
How many numbers are employed?
What is each one called?
What are they called together?
What is the answer called?
What is to be done, before you begin to perform questions in multiplication?
What is the first case?
How must the numbers be written down?
Where do you begin, & how proceed?
When you carry, to what do you add the figure carried?
Why so?
What is the second case?
How many figures of the multiplier do you use at a time?
When you have multiplied the first figure of the multiplicand by the second figure of the multiplier, where do you begin to set it down?
Why do you set it under that figure, rather than under the figure multiplied?
When you have multiplied by all the figures of the multiplier, what do you do next?
What is the third case?
What do you do with cyphers at the right hand of the factors?
Why do you annex them to the right hand of your product?
What do you do with cyphers between other figures of your multiplier?
What is the first method of proof? second?
Which is the safest?
What is the third method of proof?
In the third method, what is the first thing to be done? the second? the third?
When do you conclude the work is right?
Is this method of proof certain?
Why so?
Why then is it retained?

Exercise 8.

Tell the amount of

3×2×2,	*Ans.*	12	3×3×5,	*Ans.*	45	5×3×2,	*Ans.*	30
3 3 2,		18	3 4 5,		60	5 2 4,		40
2 2 4,		16	3 2 6,		36	5 5 4,		100
2 3 3,		18	3 2 4,		24	6 2 2,		24
2 3 4,		24	3 3 3,		27	6 3 2,		36
2 2 5,		20	4 3 3,		36	6 4 2,		48
2 3 5,		30	5 2 2,		20	6 4 3,		72

Exercise 9.

Tell the amount of

2×5×10,	*Ans.*	10	4×2×4,	*Ans.*	32	8× 5×1	*Ans.*	40
2 3 8,		48	5 2 5,		50	9 4 2,		72
3 4 8,		96	5 2 2,		20	9 10 2,		180
5 6 2,		60	6 5 2,		60	2 1 9,		18
5 5 2,		50	7 2 1,		14	3 3 9,		81
3 5 5,		75	8 3 2,		48	2 5 9,		90
3 4 4,		48	8 4 3,		96	4 10 3,		120

Exercise 10.

From	take	*Ans.*	From	take	*Ans.*	From	take	*Ans.*
24,	4× 5,	4	36,	9× 3,	9	37,	7× 4,	9
28,	3 5,	13	45,	3 12,	9	41,	6 5,	11
20,	2 7,	6	24,	4 3,	12	29,	7 3,	8
19,	3 4,	7	28,	4 4,	12	36,	8 4,	4
14,	5 2,	4	32,	5 3,	17	19,	3 4,	7
31,	7 4,	3	18,	3 5,	3	25,	8 2,	9
27,	2 8,	11	22,	5 3,	7	38,	2 11,	16

Exercise 11.

From	take	*Ans.*	From	take	*Ans.*	From	take	*Ans.*
100,	8× 8,	36	72,	4×12,	24	85,	6×12,	13
96,	4 12,	48	67,	8 6,	19	94,	8 9,	22
72,	7 9,	9	98,	6 11,	32	105,	6 11,	39
66,	9 5,	21	102,	9 8,	30	86,	9 5,	41
48,	6 5,	18	55,	6 7,	13	74,	7 6,	32
84,	5 12,	24	48,	4 7,	20	65,	5 7,	30
67,	7 7,	18	79,	7 8,	23	47,	7 5,	12

DIVISION,

Is a short method of performing subtraction, and teaches to find how often one number is contained in another.

It is called Simple Division, when the number to be divided is of one denomination.

The number to be divided, is called the *dividend;* the number to divide by, is called the *divisor;* and the result, or answer, is called the *quotient.*

Note. Before proceeding to perform operations in division, let the student learn the multiplication table in an inverted order, as follows: 2 in 4 is twice, 2 in 6 is 3 times, 2 in 8 is 4 times, &c.

Rule.

1. Set down the dividend first, and the divisor at the left hand of it, separated by a curve line; and leave a place at the right to set the quotient, separated also from the dividend by a curve line.

2. Take the fewest figures of the dividend, beginning at the left hand, that will contain the divisor, and see how many times they will contain it, and place the figure denoting that number of times, for the first figure of the quotient.

3. Multiply the divisor by that quotient figure, and place the product under those figures of the dividend before mentioned.

4. Subtract this product from that part of the dividend under which it stands, and set down the remainder.

5. Bring down another figure of the dividend, and place it at the right hand of the remainder, and then divide as before this number so increased; but if, when one figure is brought down, the divisor is not contained in it, set down a cypher in the quotient, and bring down another figure of the dividend; and so on, till all the figures of the dividend are brought down and divided.

Example. Divide 561720 by 24.

Divis. Divid. Quot.

```
24)561720(23405
  48
  --
   81
   72
   --
    97
    96
    --
     120
     120
     ---
```

Work. First, write down the dividend, and at the left hand of it, the divisor, separated from it by a curve line, and put another curve line at the right, to separate the quotient.

Next, consider how few figures of the dividend will contain the divisor; the first one, 5, will not, but the two first, 56, will; and 24 in 56 is 2 times; set down 2 in the quotient, and multiply the divisor by it. 2 times 4 is 8;

set down 8 under the 6. 2 times 2 is 4; set down 4. Then subtract. 8 from 6 I cannot, but 8 from 16 leaves 8; set down 8. 1 carried to 4 is 5; 5 from 5 leaves nothing. The remainder is 8. To this bring down the next figure of the dividend, which is 1, and it makes 81. Then divide again. 24 in 81 is 3 times; set down 3 in the quotient, and multiply. 3 times 4 is 12; set down 2 under the 1, and carry 1. 3 times 2 is 6, and 1 I carried is 7; set down 7. Then subtract. 2 from 1 I cannot, but 2 from 11 leaves 9; set down 9. 1 carried to 7 is 8; 8 from 8 leaves 0. The remainder is 9, to which bring down 7, and it makes 97. Then divide again. 24 in 97 is 4 times; set down 4 in the quotient, and multiply. 4 times 4 is 16; set down 6 under the 7, and carry 1. 4 times 2 is 8, and 1 I carried is 9; set down 9. Then subtract. 6 from 7 leaves 1; set down 1. 9 from 9 leaves 0. The remainder is 1, to which I bring down 2, and it makes 12. Then divide again. 24 in 12 is 0 times; set down 0 in the quotient, and bring down the next figure of the dividend, which is 0, and annex it to the 12, and it makes 120. Then divide again. 24 in 120 is 5 times; set down 5 in the quotient, and multiply. 5 times 4 is 20; set down 0 under the 0, and carry 2. 5 times 2 is 10, and 2 I carried is 12; set down 12. This product being equal to the number from which it is to be subtracted, there is no remainder; and there being no more figures of the dividend to bring down, the work is finished, and the quotient is 23405.

Proof.

Multiply the quotient by the divisor, and to the product add the remainder, if any; and the amount will be equal to the dividend, if the work is right.

Contractions in Division.

1. Division by a number not exceeding 12, may be expeditionsly performed, by multiplying and subtracting in the mind, omitting to set down the work, excepting only the quotient, which may be set down immediately below the dividend.

2. When the right hand figure or figures of the divisor are cyphers, cut them off, and also cut off as many figures from the right hand of the dividend; then divide the remaining figures of the dividend by the remaining figures of the divisor. If any thing remains after this division, annex to the right of it the figures cut off from the dividend, and the whole will be

the true remainder; if nothing remains from the division, the figures cut off will be the remainder.

Note 1. This method is used only to avoid the needless repetition of cyphers which would happen in the common way.

Note 2. The proper way of setting down a remainder after division, is to place it at the right hand of the quotient, with the divisor under it, and a line between, in the form of a vulgar fraction.

Questions.

1. If there are 1189 chapters in the bible, and a child should read 2 chapters a day, how many days would it take him to read it through? *Ans.* 594½.

2. If a Christian school for 50 heathen children, can be kept in Ceylon for 2 00 cents a year, according to the statement of the missionaries there, how many cents is that for each child? *Ans.* 48.

3. If the population of the United States is 9630400, and one minister of the gospel is necessary for every 800 souls, how many ministers are necessary in the United States? *Ans.* 12038.

Questions on the foregoing.

What is division?
When is it called simple division?
What is the dividend? divisor? quotient? [down?
How are the numbers to be written
Where do you begin to divide?
How many figures of the dividend do you take?
Where do you set your quotient figure?
What do you do next?
From what do you subtract?
What do you do after subtracting?
How many figures do you bring down at a time?
What do you do, when the divisor is not contained in the remainder so increased?
How do you prove division?
What is the first method of contracting division? the second?
In the second method, what is the true remainder?
How should the remainder be set down?
What is the result of an operation in addition called? in subtraction? in multiplication? in division?

Exercise 12.

Tell how many times

5 in 25,	*Ans.* 5	4 in 32,	*Ans.* 8	9 in 108,	*Ans.* 12
4 in 20,	5	3 in 33,	11	6 in 30,	5
6 in 36,	6	5 in 100,	20	5 in 45,	9
7 in 42,	6	9 in 54,	6	9 in 72,	8
8 in 56,	7	7 in 63,	9	12 in 96,	8
8 in 24,	3	12 in 120,	10	9 in 63,	7
3 in 27,	9	5 in 20,	4	11 in 99,	9

Exercise 13.

Tell how many times

2 in 4× 4,	*Ans.* 8	2 in 5× 6,	*Ans.* 15	3 in 6× 4,	*Ans.* 8
3 in 2 6,	4	3 in 9 2,	6	4 in 3 8,	6
4 in 2 10,	5	4 in 8 6,	1	8 in 4 12,	6
5 in 10 4,	8	5 in 4 4,	2	6 in 3 4,	2
4 in 8 2,	4	12 in 6 6,	3	8 in 4 6,	3
4 in 6 2,	3	3 in 2 15,	10	3 in 2 9,	6
6 in 3 8,	4	5 in 3 10,	6	9 in 3 12,	4

Exercise 14.

Tell how many times

7 in 3×21,	*Ans.* 9	7 in 3×14,	*Ans.* 6	6 in 2×18,	*Ans.* 6
5 in 2 15,	6	9 in 4 18,	8	4 in 2 14,	7
8 in 3 16,	6	3 in 4 12,	16	8 in 2 20,	5
6 in 4 12,	8	9 in 2 27,	6	7 in 3 21,	9
8 in 6 12,	9	5 in 3 20,	12	8 in 4 16,	8
5 in 4 15,	12	9 in 3 15,	5	9 in 2 18,	4
6 in 9 10,	15	8 in 2 16,	4	6 in 5 12,	10

Exercise 15.

Tell how many times

	Ans.		*Ans.*		*Ans.*
6 in 3×2×3,	3	6 in 3×2×4,	4	4 in 5×2×2	5
8 in 2 2 4,	2	4 in 3 2 6,	9	6 in 3 7 2,	7
10 in 2 2 5,	2	4 in 2 2 5,	5	8 in 5 4 4,	10
8 in 2 3 4,	3	12 in 6 4 3,	6	6 in 4 5 3,	10
6 in 2 3 5,	5	8 in 5 2 4,	5	6 in 4 3 3,	6
12 in 3 4 5,	5	10 in 5 5 4,	10	12 in 8 2 6,	8
9 in 3 2 6,	4	12 in 3 2 4,	2	10 in 5 6 3,	

Exercise 16.

Tell the sum of

	Ans.		*Ans.*		*Ans.*
7+2+4+5,	18	9+2+1+4,	16	5+4+9+2,	20
9 1 2 3,	15	7 8 3 1,	19	6 2 8 3,	19
8 6 2 1,	17	2 8 3 4,	17	7 4 3 2,	16
8 5 1 2,	16	2 7 5 2,	16	2 9 8 1,	20
7 3 4 1,	15	3 6 9 3,	21	3 7 5 2,	17
8 5 3 4,	20	4 5 6 4,	19	4 9 2 3,	18
8 1 2 6,	17	4 8 5 3,	14	9 6 7 3,	25

Exercise 17.

Tell the sum of

	Ans.		*Ans.*		*Ans.*		*Ans.*
24+33,	57	35+61,	96	66+24,	90	44+52,	96
75 26,	101	45 24,	69	51 32,	83	33 53,	86
27 18,	45	34 41,	75	36 48,	84	47 26,	73
92 13,	105	27 49,	76	24 47,	71	22 34,	56
79 24,	103	39 28,	67	55 35,	90	54 21,	75

Exercise 18.

Tell the sum of

	Ans.		*Ans.*		*Ans.*		*Ans.*
87+28,	115	65+41,	106	54+55,	109	72+45,	117
65 43,	108	96 70,	166	71 36,	107	84 47,	131
91 42,	133	67 36,	103	83 42,	125	69 56,	125
82 27,	109	78 87,	165	64 59,	123	85 64,	149
73 37,	110	62 76,	138	78 58,	136	74 66,	140

Exercise 19.

Tell how many times

	Ans.		*Ans.*		*Ans.*
7 in 13+15,	4	8 in 19+29,	6	9 in 87+35,	8
6 in 21 15,	6	9 in 13 23,	4	7 in 11 17,	4
3 in 11 16,	9	8 in 45 27,	9	6 in 33 15,	8
4 in 13 19,	8	7 in 55 29,	12	5 in 41 19,	12
8 in 27 29,	7	6 in 26 40,	11	7 in 21 28,	7
5 in 21 14,	7	5 in 13 32,	9	8 in 17 23,	5
7 in 25 31,	8	8 in 27 13,	5	4 in 20 32,	13

Exercise 20.

From	take,	and tell the	*Ans.*	From	take,	and tell the	*Ans.*
27,	3,	half,	12	66,	3,	ninth,	7
26,	5,	third,	7	73,	7,	eleventh,	6
21,	6,	fifth,	3	29,	5,	sixth,	4
21,	5,	fourth,	4	35.	7,	fourth,	7
36,	6,	fifth,	6	43,	8,	seventh,	5
41,	5,	third,	12	52,	4,	sixth,	8
51,	9,	sixth,	7	57,	15,	sixth,	7
62,	14,	eighth,	6	63,	15,	eighth,	6
79,	7,	sixth,	12	54,	9,	third,	15
84,	7,	seventh,	11	64,	8,	seventh,	8

REDUCTION,

Is the changing of numbers from one name or denomination to another, without altering their value.

Before proceeding to operations in reduction, the following tables should be committed to memory, as far as Table 15.

REDUCTION TABLES.

1. Federal Money.

10 mills, *(m.)* make	1 cent, *ct.*
10 cents,	1 dime, *d.*
10 dimes, or 100 cents,	1 dollar, $, or *D.*
10 dollars,	1 Eagle, *E.*

Note. In stating any sum in Federal Money, eagles and dimes are usually neglected, and dollars and cents only are mentioned, 100 cents making a dollar. The dollar is considered the money unit, and the lower denominations as decimal parts of a dollar.

2. Sterling Money, *and old Currencies of the several States.*

4 farthings, *(q.)* make	1 penny, *d.*
12 pence,	1 shilling, *s.*
20 shillings,	1 pound, £, or *l.*

Note. Farthings are usually written as fractional parts of a penny, as $\frac{1}{4}d.$ is 1 farthing; $\frac{2}{4}d.$ is a halfpenny, or 2 farthings; $\frac{3}{4}d.$ is 3 farthings.

3. Troy Weight.

24 grains, *(gr.)* make	1 pennyweight, *dwt.*
20 pennyweights,	1 ounce, *oz.*
12 ounces,	1 pound, *lb.*

Note. A grain is equal to 87 ten thousandths of a solid inch of pure water. This weight is used for gold, silver, jewels, electuaries, and liquors. The fineness of gold is tried by fire, and is reckoned in *carats.* If it loses nothing in the trial, it is said to be 24 carats fine. If it loses 2 twenty-fourths, it is said to be 22 carats fine, which is the standard for gold. Silver, which loses nothing in the fire, is said to be 12 ounces fine. The standard for silver coin, is 11*oz.* 2*dwt.* of pure silver, and 18*dwt.* of copper, melted together.

4. Avoirdupois Weight.

16 drams, *(dr.)* make	1 ounce, *oz.*
16 ounces,	1 pound, *lb.*
28 pounds,	1 quarter, *qr.*
4 quarters,	1 hundred, *Cwt.* or *C.*
20 hundreds,	1 Ton, *T.*

1 quintal of fish, is equal to 1 *Cwt.*

Note. This weight is used for provisions, groceries, hay, iron, lead, and, in general, for all coarse and bulky articles. 192 ounces Avoirdupois are equal to 175 ounces Troy; and 144*lbs.* Avoirdupois, to 175*lbs.* Troy; and 1*lb.* Aveirdupois, to 7000 grains Troy, or to 27·664 solid inches of pure water.

5. Apothecaries' Weight.

20 grains, *(gr.)* make	1 scruple, *sc.* or ℈
3 scruples,	1 dram, *dr.* or ʒ
8 drams,	1 ounce, *oz.* or ℥
12 ounces,	1 pound, *lb.*

Note. This weight is used for compounding medicines. A pound of this weight is the same as a pound Troy.

6. Cloth Measure.

2¼ inches, *(in.)* make	1 nail, *na.*
4 nails,	1 quarter, *qr.*
4 quarters,	1 yard, *yd.*
3 quarters,	1 ell Flemish, *E. Fl.*
5 quarters,	1 ell English, *E. E.*
6 quarters,	1 ell French, *E. Fr.*

7. Long Measure.

6 points, *(pt.)* make	1 line, *l.*
4 lines,	1 barley corn, *b. c.*
3 barley corns,	1 inch, *in.*
12 inches,	1 foot, *ft.*
3 feet,	1 yard, *yd.*
16½ feet, or 5½ yds.	1 rod, pole, or perch, *r.* or *p.*
4 rods, or 66 feet,	1 chain, *ch.*
10 chains, or 40 rods,	1 furlong, *fur.*
8 furlongs, or 5280 ft.	1 mile, *m.*
3 miles,	1 league, *L.*
69½ statute miles, (nearly)	1 degree, *deg.*
360 degrees,	1 great circle of the earth, *cir.*

Note. The chain is divided into 100 links. In measuring the height of horses, 4 inches make 1 hand. In measuring depths, 6 feet make 1 fathom. Long measure is used to measure distances, or any other thing in which length is considered without regard to breadth.

8. Square Measure.

144 square inches, make	1 square foot, *ft.*
9 feet,	1 yard, *yd.*
30¼ yards, or 272¼ feet,	1 rod, pole, or perch, *r.* or *p.*
40 rods,	1 rood, *R.*
4 roods,	1 acre, *A.*
16 rods, or 10000 links,	1 chain, *ch.*
10 chains,	1 acre, *A.*
640 acres,	1 mile, *m.*

Note. This measure is used to ascertain the quantity of any thing which has length and breadth, without regard to thickness, as the floor of a room, the content of a piece of land, &c. The length and breadth being multiplied together, to make the area, or superficial content. Hence, 144 inches make 1 foot; because 12 inches in length, and 12 inches in breadth, being multiplied together, make 144 square inches in one square foot.

9. Solid or Cubic Measure.

1728 solid inches, make	1 solid foot, *ft.*
27 feet,	1 yard, *yd.*
40 feet of round timber, or	
50 feet of hewn timber,	1 ton, or load, *T.*
128 feet of wood,	1 cord, *c.*

Note. This measure is used to ascertain the quantity of any thing which has length, breadth and thickness, and to regulate all measures of capacity, of whatever form. A solid foot contains 1728 solid inches; because it is 12 inches long, 12 inches broad, and 12 inches thick, and 12x12x12, or the *cube* of 12, is 1728.

10. Dry Measure.

33 solid inches and 3 fifths, make	1 pint, *pt.*
2 pints,	1 quart, *qt.*
4 quarts, or 268 in. & 4 fifths,	1 gallon, *gal.*
2 gallons,	1 peck, *pk.*
4 pecks, or 2150 in. & 2 fifths,	1 bushel, *b.*
8 bushels,	1 quarter, *qr.*
36 bushels,	1 chaldron, *chal.*

Note. This measure is used for grain, fruit, seeds, roots, salt, coal, &c.

11. Wine Measure.

4 gills, or 28 solid inches, and 875 thousandths, make	1 pint, *pt.*
2 pints,	1 quart, *qt.*
4 quarts, or 231 inches,	1 gallon, *gal.*
63 gallons,	1 hogshead, *hhd.*
2 hogsheads,	1 pipe, *p.*
2 pipes,	1 tun, *T.*

Note. This measure is used for wine, spirits, vinegar, oil, &c.

12. Ale, or Beer Measure.

35¼ inches, make	1 pint, *pt.*
2 pints,	1 quart, *qt.*
4 quarts, or 282 inches,	1 gallon, *gal.*
8 gallons,	1 firkin of ale, *A. fir.*
9 gallons,	1 firkin of beer, *B. fir.*
2 firkins,	1 kilderkin, *kil.*
2 kilderkins,	1 barrel,
3 barrels,	1 butt, *Bt.*

13. TIME.

60 seconds, *(sec.)* make	1 minute, *min.*
60 minutes,	1 hour, *hr.*
24 hours,	1 day, *d.*
7 days,	1 week, *w.*
4 weeks,	1 lunar month, *l. m.*
365¼ days, (nearly,) or 13 lunar months, and 1¼ days; or 12 solar months,	1 year, *yr.*
100 years,	1 century, *cent.*

Note. In reckoning time, 365 days are usually considered a year, which is divided into 12 calendar months, as follows: January, 31 days; February, 28; March, 31; April, 30; May, 31; June, 30; July, 31; August, 31; September, 30; October, 31; November, 30; December, 31. The quarter of a day is reserved till it becomes a whole day, which is every fourth year, and then it is added to the month of February, which then has 29 days: and that year is called leap year. To know whether any year is leap year, divide it by 4 and if there is no remainder, it is leap year. But as the true year is 11 minutes and 12 seconds less than 365 days and a quarter, as often as this deficiency makes up a day, the additional day for leap year is omitted: which is once in about 130 years.

14. CIRCULAR MOTION.

60 thirds, *(‴)* make	1 second, ″
60 seconds,	1 minute, ′
60 minutes,	1 degree, °
30 degrees,	1 sign, *S.*
12 signs, or 360 deg.	1 circle, or complete revolution of the Zodiac.

15. PARTICULARS.

12 particulars, make	1 dozen, *doz.*
20 particulars,	1 score, *sc.*
12 dozen,	1 gross, *gr.*
12 gross,	1 great gross, *g. gr.*

16. COINS AND CURRENCIES.

The Spanish or Federal dollar is equal to

4*s.* 6*d.* Sterling money of Great Britain;
4 .. 10½ Irish;
5 .. 0 Canada and Nova-Scotia;
6 .. 0 New-England, Virginia, Kentucky, and Tennessee;
8 .. 0 New-York and North-Carolina;
7 .. 6 Pennsylvania, N. Jersey, Delaware, and Maryland;
4 .. 8 South-Carolina and Georgia;
5 livres and 2 fifths, of France;
2 guilders, or florins, and 4 sevenths, of the Netherlands;
3 marcs banco of Hamburgh;
1 rix dollar of Denmark, Sweden and Hamburgh;
10 rials of plate, or 20 rials of vellon, of Spain.

Gold Coins.

Johannes, equal to	$16·00,	weighs 18*dwt.*	0*gr.*
Doubloon,	14·933,	16 ..	21
Moidore,	6·00,	6 ..	18
English guinea,	4·667,	5 ..	6
French guinea,	4·60,	5 ..	5
Spanish pistole,	3·773,	4 ..	6
French pistole,	3·667,	4 ..	4
Louis d'or,	4·444,		

Silver Coins.

English or French crown,	$1·10,	weighs 19*dwt.*	0*gr.*
Spanish dollar,	1·00,	17 ..	6
English shilling,	·222,	3 ..	18
Pistareen,	·20,	3 ..	11

All other gold coins of equal fineness, at 89 cents per *dwt.* and silver at 111 cents per *oz.* An English guinea is usually reckoned 21*s.* sterling, and a crown 5*s.*

Other Currencies.

Ruble of Russia,	$0·55	Pagoda of India,	$1·84
Franc of France,	·1813	Rupee of Bengal,	·50
Mill ree of Portugal,	1·24	Piastre of Turkey,	·888+
Tale of China,	1·48	Ducat banco of Venice,	·926
Sequin of Arabia,	1·64	Ducat of Vienna,	2·055+

But these often vary according to the rate of exchange.

17. Ancient Weights, Coins, and Measures.

Hebrew, Greek, and Roman drachma or dram, equals 2*dwt* 6*grs.* and 3 fourths, Troy weight. Dram of silver, 6 pence and 27 thirty-seconds sterling, or 12 cents and 97 one hundred and forty-fourths. Dram of gold, 9*s.* 1*d.* 2*q.* sterling, or 2 dolls. 2 cts. and 7 ninths. Shekel of silver, brass, iron, &c. 4 drachmæ. Shekel of gold, 2 drachmæ. 5 gerahs make 1 drachma. Mina or pound, 60 shekels. Hebrew talent, 12000 drachmæ Attic mina, 100 drachmæ. Smaller Attic talent, 6000 drachmæ. Greater Attic talent, 8000 drachmæ. Stater of silver, 4 drachmæ. Stater of gold, 2 drachmæ. 7 lepta, or mites, 1 chalcus; 8 chalci, 1 obolus; 6 oboli, 1 drachma. Roman ounce, 8 drachmæ; pound, 96 drachmæ. 4 terentii, or quadrantes, 1 as; 2 and a half asses, 1 sestertius, or nummus; 4 sestertii, 1 denarius, penny, or drachma. Sestertium, 1000 sestertii. Roman talent, 24 sestertia, or 6000 drachmæ.

Note. The *as* is often expressed, in the Latin classics, by L. for *libra*, a pound, because it was originally a pound of brass. The *sestertius*, by LLS, (corrupted into HS,) two pounds and a half. When a genitive plural is used after a numeral adjective, it denotes so many thousands; and when after a numeral adverb, so many hundred thousands.

Long Measure. Hebrew. 4 fingers' breadth, 1 hand breadth; 2 hand breadths, 1 shorter span; 3 hand breadths, 1 longer span; 2 longer spans, 1 cubit, equal to 1·824 English feet; 4 cubits, 1 fathom; 6 cubits, 1 Ezekiel's reed; 80 cubits, 1 schœnus, or measuring line; 667·5 English feet, 1 stadium, or furlong; 8 stadia, 1 mile; 30 stadia, 1 parasang; 240 stadia, 1 day's journey; 5 stadia, 1 Sabbath day's journey.

Greek. 4 fingers, 1 doron; 4 dora, 1 foot, equal to 12·0875 English inches; 18 fingers, 1 pugme, or smaller cubit; 24 fingers, 1 pechus, or larger cubit; 4 larger cubits, 1 orguia, or pace; 100 paces, 1 stadium; 8 stadia, 1 mile.

Roman. 4 fingers, 1 palmus minor; 4 palmi, 1 foot, equal to 11·604 English inches; 24 fingers, 1 cubit; 40 fingers, 1 gradus; 5 feet, 1 passus; 625 feet, 1 stadium; 1000 passus, 1 mile.

Square Measure. Greek or Egyptian aroura, 10000 square cubits; Greek plethron, 2 arouræ; Roman jugerum, 2 English roods, 10 poles, and 250·05 feet.

Cubic Measure. Hebrew. 10 avoirdupois ounces of rain water, 1 cotyla; 10 cotylæ, 1 gomer, or omer; 10 omers, 1 bath, ephæ, or metretes, equal to 60 English wine pints, and 15 solid inches; 3 baths, 1 rebel; 5 baths, 1 lethech; 10 baths, 1 cor, or homer. 6 eggs, or betzahs, 1 log, or rebah; 4 logs, 1 cab; 3 cabs, 1 hin; 2 hins, 1 seah; 3 seahs, 1 bath.

Greek, for liquids. 5 cochlearia, 1 concha; 2 conchæ, 1 cyathus; 6 cyathi, 1 cotyle; 2 cotylæ, 1 xestes; 6 xestæ, 1 chous; 12 choi, 1 metretes, equal to 82 English wine pints, and 19·626 solid inches. *For things dry.* 3 cotylæ, 1 chœnix; 48 chœnices, 1 medimnus, equal to 4 English pecks, and 205·101 solid inches.

Roman, for liquids. 4 ligulæ, 1 cyathus; 12 cyathi, 1 sextarius; 6 sextarii, 1 congius; 4 congii, 1 urna; 2 urnæ, 1 amphora, equal to 57 English wine pints, and 10·66 solid inches; 20 amphoræ, 1 culeus. *For things dry.* 16 sextarii, 1 modius, equal to 1 English peck, and 7·68 solid inches.

18. Specific Gravities,

The following table, (taken chiefly from Enfield's Philosophy,) shows the weight in avoirdupois ounces of a solid foot of each substance.

	oz.		*oz.*		*oz.*
Platina, (pure,)	23000	White lead,	3160	Sea water,	1030
Fine gold,	19640	Marble,	2705	Rain water,	1000
Standard gold,	18888	Rock chrystal,	2658	Red wine,	993
Mercury,	14019	Green glass,	2600	Proof spirits,	925
Lead,	11325	Flint stone,	2570	Dry oak,	925
Fine silver,	11091	Brick,	2000	Olive oil,	913
Standard silver,	10535	Ivory,	1825	Ice,	908
Copper,	9000	Sulphur,	1810	Living men,	891
Gun metal,	8784	Chalk,	1793	Spts. of turpentine,	864
Fine brass,	8350	Alum,	1714	Alcohol,	850
Steel,	7850	Lignum vitæ,	1327	Elm and ash,	800
Iron,	7645	Coal,	1250	Ether,	732
Pewter,	7471	Ebony,	1117	White pine,	569
Cast iron,	7425	Mahogany,	1063	Cork,	240
Load stone,	4930	Cows' milk,	1034	Common air,	1·14
Diamond,	3517	Boxwood,	1030	Inflammable air,	·12

19. Miles of different Countries.

11 Irish equal 14 English; 1 Scotch equals 1 and a half English; 1 Indian equals 3 English; 1 Dutch, Spanish and Polish, equals 3 and a half English; 1 German equals 4 English; 1 Swedish, Danish, and Hungarian, equals 5 and a half English; 1 Russian verst equals 3 quarters of a mile English.

☞ *Sound* moves 1142 feet in one second of time.

Light flies from the sun to the earth, which is nearly 94 millions of miles, in about 8 minutes of time, which is nearly 195834 miles per second; so that for any short distance it may be considered instantaneous.

REDUCTION,

Is performed by multiplication and division.

Rule.

1. When the given number is to be reduced from a higher denomination to a lower, multiply the given number of the highest denomination by as many units as it takes of the next lower to make one of that higher; to this product add the number, if any, which was in this lower denomination before, and set down the amount. And so on, through all the denominations, till you have brought the number into the denomination required.

2. When the given number is to be reduced from a lower denomination to a higher, divide the given number by as many units as it takes of that denomination to make one of the next higher, and set down what remains, as well as the quotient. And so on, through all the denominations, till you have brought the given number into the denomination required.

Example 1.

Reduce £1234 .. 15 .. 7, to farthings.

Operation.

l. *s.* *d.*
1234 .. 15 .. 7
20
——
24680
15
——
24695 *s.*
12
——
296340
7
——
296347 *d.*
4
——
1185388 *q. Answer.*

Explanation. Here, because 20 shillings make 1 pound, I multiply the 1234 pounds by 20, to bring them into shillings, and have 24680 shillings, to which I add the 15 shillings of the given number, and have 24695 shillings. Then, because 12 pence make 1 shilling, I multiply the 24695 shillings by 12, to bring them into pence, and have 296340 pence, to which I add the 7 pence of the given number, and have 296347 pence. Then, because 4 farthings make 1 penny, I multiply the 296347 pence by 4, to bring them into farthings, and have 1185388 farthings; and as there were no farthings in the given number, I have nothing to add, and the answer is 1185388 farthings.

EXAMPLE 2.

Reduce 1185388 farthings to pounds.

Operation.

4)1185388 *q.*
12)296347 *d.*
20)24695 *s.* 7*d.*
£1234 .. 15 .. 7,
Answer.

Explanation. Here, because 4 farthings make 1 penny, I divide the given farthings by 4, to bring them into pence, and have 296347 pence. Then, because 12 pence make 1 shilling, I divide the pence by 12, to bring them into shillings, and have 24695 shillings, and 7 pence remains, which I set down. Then, because 20 shillings make 1 pound, I divide the shillings by 20, to bring them into pounds, and have 1234 pounds, and 15 shillings remains. So the answer is 1234*l.* 15*s.* 7*d.*

QUESTIONS.

1. In the year 1819, the receipts of the British and Foreign Bible Society were 93033*l.* 6*s.* 7*d.*, how many farthings was that? *Ans.* 89311996.

2. The time from the creation to the flood was 14 centuries and 56 years; how many calendar months was it? *Ans.* 17472.

3. The highest mountain in the known world is Himalaya, in India, which is estimated to be 952632 barley corns above the level of the sea; how many miles is that? *Ans.* 5*m.* 62*ft.*

4. The next is Chimborazo, in South America, which is estimated to be 4*m.* 330*ft.*; how many inches is that? *Ans.* 257400.

EXERCISE 21.

Tell the pence in

7*s.* 3*d.*	*Ans.* 87	8*s.* 5*d.*	*Ans.* 101
14 .. 2,	170	9 .. 9,	117
15 .. 6,	186	11 .. 11,	143
13 .. 4,	160	13 .. 6,	162
5 .. 11,	71	10 .. 5,	125
10 .. 10,	130	16 .. 0,	192
9 .. 8,	116	12 .. 6,	150
7 .. 6,	90	21 .. 0,	252
6 .. 10,	82	14 .. 8,	176

EXERCISE 22.

Tell the farthings in

3s.	8d.	*Ans.* 176	3s.	6d.	*Ans.* 168
2 ..	5,	116	2 ..	3,	108
4 ..	4,	208	4 ..	3,	204
7 ..	6,	360	2 ..	1,	100
6 ..	2,	296	3 ..	4,	160
5 ..	6,	264	4 ..	$1\frac{1}{2}$,	198
3 ..	5,	164	1 ..	$1\frac{1}{4}$,	53
2 ..	6,	120	3 ..	$3\frac{1}{4}$,	158
4 ..	5,	212	2 ..	$4\frac{1}{2}$,	114

COMPOUND ADDITION,

Is the addition of several numbers of different denominations, but of the same general nature.

RULE.

1. Write down the numbers in such a manner that those of the same denomination may stand directly under each other, and the lowest denomination at the right hand, the next lowest next, and so on; and draw a line underneath.

2. Add up the numbers of the right hand column, as in simple addition; and find, by reduction, how many units of the next higher denomination are contained in their sum. Set down the remainder under that column, and carry those units to the next column.

3. Proceed in the same manner through the several denominations, to the highest, the sum of which, together with the several remainders, at the foot of the other columns, will be the answer sought.

EXAMPLE.

Cwt.	*qr.*	*lb.*	*oz.*
3 ..	3 ..	15 ..	8
4 ..	2 ..	21 ..	9
8 ..	1 ..	27 ..	10
4 ..	3 ..	17 ..	11
5 ..	1 ..	13 ..	15
21 ..	1 ..	12 ..	5

Answer.

Work. Begin with the right hand column, at the bottom, and say, 15 and 11 is 26, and 10 is 36, and 9 is 45, and 8 is 53. This is 53 ounces; and as 16 ounces make 1 pound, divide 53 by 16. 16 in 53 is 3 times, and 5 remains. Set down 5 ounces, and carry 3 to the column of pounds. *Second column.* 3 carried to 13 is 16, and 17 is 33, and 27 is 60, and 21 is 81, and 15 is 96. This is 96 pounds; and as 28*lb.* make 1 quarter, divide 96 by 28. 28 in 96 is 3 times, and 12 remains. Set down 12*lb.* and carry 3 to the next. *Third column.* 3 carried to 1 is 4,

and 3 is 7, and 1 is 8, and 2 is 10, and 3 is 13. This is 13 quarters; and as 4 quarters make 1 *Cwt.* divide 13 by 4. 4 in 13 is 3 times, and 1 remains. Set down 1*qr.* and carry 3 to the next. *Fourth column.* 3 carried to 5 is 8, and 4 is 12, and 3 is 15, and 4 is 19, and 3 is 22. This is 22 *Cwt.*; and as this is the last column, set down 22 *Cwt.* And the answer is 22 *Cwt.* 1*qr.* 12*lb.* 5*oz.*

QUESTIONS.

1, The government expenses of the United States for the year 1819, were estimated as follows: Civil, diplomatic, and miscellaneous, D.1619836·31; military and Indian, D.8666-252·85; naval, D.3802486·60; public buildings, and roads, D.326644; public debt, D.10000000; erecting custom houses, &c. D.100000: what is the amount?

Ans. 24515219·76.

2. The receipts of the B. and F. Bible Society for the first eleven years, were as follows: First, 5592*l.* 10*s.* 5*d.*; second, 8827*l.* 10*s.* 3¾*d.*; third, 6998*l.* 19*s.* 7*d.*; fourth, 10039*l.* 12*s.* 0½*d.*; fifth, 11289*l.* 15*s.* 3*d.*; sixth, 23337*l.* 0*s.* 2¼*d*; seventh, 25998*l.* 3*s.* 1*d.*; eighth, 4353*l.* 12*s.* 5½*d.*; ninth, 76455*l.* 1*s.*; tenth, 87216*l.* 6*s.* 9*d.*; eleventh, 99894*l.* 15*s.* 6*d.*: how much in all? *Ans.* 399182*l.* 6*s.* 7*d.*

3. Tell the whole weight of the following parcels of medicine, to wit: First, 3*lb.* 5*oz.* 7*dr.* 2*sc.*; second, 6*oz.* 5*dr.* 1*sc.* 16*gr.*; third, 5*lb.* 1*oz.* 6*dr.* 2*sc.* 10*gr.*; and the fourth, 9*oz.* 3*dr.* 19*gr.* *Ans.* 9*lb.* 11*oz.* 7*dr.* 1*sc.* 5*gr.*

4. Add the following distances, and tell the amount: first, 127*yd.* 1*ft.* 5*in.* 2*b.* c.; second, 12*yd.* 10*in.* 1*b.* c.; third, 2*ft.* 11*in.*; fourth, 9*yd.* 7*in.* 2*b.* c.; and fifth, 12*yd.* 2*ft.* 1*b.* c.

Ans. 162*yd.* 1*ft.* 11*in.*

5. Five vessels of wine contain as follows: first, 61 *gal.* 2*qt.*; second, 30 *gal.* 1*qt.* 1*pt.* 3*g.*; third, 48 *gal.* 3*qt.* 3*g.*; fourth, 57 *gal.* 1*pt.*; fifth, 1 *hhd.* 60 *gal.* 1*pt.* 3*g.*: what is the whole quantity? *Ans.* 5 *hhd.* 6 *gal.* 1*pt.* 1*g.*

COMPOUND SUBTRACTION,

Is the subtraction of one number from another, when those numbers are made up of different denominations, but of the same general nature.

RULE.

1. Set down the less number under the greater, in such a manner that those parts which are of the same denomination

may stand under each other, and the lower denomination at the right hand of the higher.

2. Begin at the right hand, and subtract each part in the lower line from that above, and set down the difference.

3. But if any part in the lower line is greater than that above it, borrow as many of that denomination as makes one of the next higher, and add to the upper part, and then subtract the lower part from the upper one thus increased, and set down the remainder.

4. Carry 1 to the next higher denomination in the lower line, as an equivalent to what you borrowed in the upper, and proceed as before; and so on, till the whole is finished. Then the several remainders, taken together, will be the whole difference sought.

EXAMPLE.

	l.	*s.*	*d.*
From	345 ..	19 ..	6¾
Take	97 ..	10 ..	8½
	248 ..	8 ..	10¼
	Answer.		

Work. Begin with the farthings at the right hand, and say, a halfpenny, or 2 farthings from 3 farthings, leaves one farthing, or ¼ of a penny. Set down ¼*d.* *Pence.* 8 from 6 I cannot. As 12 pence make 1 shilling, I borrow 12 and add to the 6, and it makes 18; 8 from 18 leaves 10. Set down 10, and carry 1. *Shillings.* Having added 12 pence, or 1 shilling, to the upper line in the column of pence, I must now carry or add 1 shilling to the lower line in the column of shillings, as an equivalent. 1 to 10 is 11; 11 from 19 leaves 8. Set down 8. *Pounds.* 7 from 5 I cannot. This being the last and highest denomination, I cannot borrow as many as makes one higher, but must proceed as in simple subtraction. Borrow 10, and add to the 5, and it makes 15; 7 from 15 leaves 8. Set down 8, and carry 1. 1 to 9 is 10; 10 from 4 I cannot. Borrow 10, and 10 from 14 leaves 4. Set down 4, and carry 1. 1 to 0 is 1; 1 from 3 leaves 2. Set down 2. And the answer is 248*l.* 8*s.* 10¼*d.*

QUESTIONS.

1. The total expenditure of the B. and F. Bible Society for the first seventeen years, was 908248*l.* 10*s.* 6*d.*, of which 828687*l.* 17*s.* were expended in the first sixteen years; what was the expenditure of the seventeenth?

Ans. 79560*l.* 13*s.* 6*d.*

2. The Baptist missionaries at Serampore had expended in translating and printing the scriptures, from 1799 to 1809, $36445·72, and had received for that purpose, $39574·17: what was then unexpended? *Ans.* $3128·45.

3. A jeweller bought 7*lb.* 3*oz.* 14*dwt.* 11*gr.* of silver, and made up into spoons 3*lb.* 7*oz.* 15*dwt.* 19*gr.*; how much was left? *Ans.* 3*lb.* 7*oz.* 18*dwt.* 16*gr.*

4. Bought 5 *Cwt.* 17*lb.* 5*oz.* 6*dr.* of sugar, and sold 3 *Cwt.* 2*qr.* 21*lb.* 3*oz.* 10*dr.*; how much was left?

Ans. 1 *Cwt.* 1*qr.* 24*lb.* 1*oz.* 12*dr.*

COMPOUND MULTIPLICATION,

Is when the multiplicand consists of different denominations.

Rule 1.

1. Set the multiplier under the lowest denomination of the multiplicand.

2. Multiply the lowest denomination of the multiplicand by the multiplier; find how many units of the next higher denomination are contained in that product, set down the remainder, and carry those units to the product of the next denomination.

3. Multiply the next denomination of the multiplicand by the multiplier, add to that product what was carried from the product of the denomination below, find how many units of the next higher denomination are contained in this product so increased, set down the remainder, and carry those units to the product of the next denomination.

4. Proceed in this manner to the highest denomination, and set down the whole of that product, which, together with the several remainders, will be the answer.

Example 1.

	l.	*s.*	*d.*
Multiply	35	15	9¾
By			7
Prod.	250	10	4¾

Work. Begin with the farthings, at the right hand column, and say, 7 times 1 farthing is 7 farthings, which is 1 penny and 3 farthings. Set down ¾, and carry 1 to the pence. *Pence.* 7 times 9 is 63, and 1 I carried is 64. 64 pence is 5 shillings and 4 pence. Set down 4, and carry 5. *Shillings.* 7 times 15 is 105, and 5 I carried is 110. 110 shillings is 5 pounds and 10 shillings. Set down 10, and carry 5. *Pounds.* 7 times 5 is 35, and 5 I carried is 40. Set down 0, and carry 4. 7 times 3 is 21, and 4 I carried is 25. Set down 25; and the answer is 250*l.* 10*s.* 4¾*d.*

Example 2.	Example 3.	Example 4.
lb. oz. dwt. gr.	*M. fur. p. yd. ft.*	*w. d. hr. min. sec.*
Mult. 21 .. 1 .. 7 .. 13	24 .. 3 .. 20 .. 4 .. 2	3 .. 6 .. 20 .. 35 .. 51
By 4	5	6
Prod. 84 .. 5 .. 10 .. 4	122 .. 1 .. 24 .. 1 .. 1	23 .. 6 .. 3 .. 35 .. 6

Rule 2.

Reduce the multiplicand to the lowest denomination of which it consists, and then multiply as in simple multiplication; reducing the product, when found, to a higher denomination, if required.

Example.

Multiply 35*l.* 15*s.* 9¼*d.* by 7.

Work, I first reduce the 35*l.* 15*s.* 9¼*d.* to farthings, and find it to be 34357 farthings. I then multiply those 34357 farthings by 7, and the product is 240499 farthings. I then reduce these 240499 farthings of the product to pounds, and have 250*l.* 10*s.* 4¾*d.* for the answer, as in the first example.

COMPOUND DIVISION,

Is when the dividend consists of different denominations.

Rule 1.

1. Write down the dividend and divisor as in simple division.

2. Find how many times the divisor is contained in the highest denomination of the dividend, and put that amount in the quotient, as a part of the answer of the same denomination.

3. If there is any remainder after the division of the highest denomination, reduce that remainder to the next lower denomination, and add to it the number (if any) which is already in that denomination.

4. Divide again, as before, and so on, till the last denomination has been divided; and the several numbers of the quotient, taken together, will be the answer.

EXAMPLE 1.

Divide 30*l.* 18*s.* 8*d.* by 16.

Operation.

16)30 .. 18 .. 8(1*l.*
16
—
14
20
—
280
18
—
298(18*s.*
16
—
138
128
—
10
12
—
120
8
—
128(8*d.*
128

Explanation. I begin with the pounds, and say, 16 in 30 is once. Set down 1 in the quotient, in the place of pounds. After multiplying and subtracting, as in simple division, I find 14 remains. This, being 14 pounds, is to be reduced to shillings; and there being 20 shillings in a pound, I multiply 14 by 20, and the product is 280, which is 280 shillings. I then add the 18 shillings of the dividend, and it makes 298 shillings. I then divide again. 16 in 29 is once, and 13 remains. Set down 1 in the quotient, in the place of shillings, and bring down the 8. 16 in 138 is 8 times, and 10 remains. Set down 8 in the quotient, also in the place of shillings, which makes 18 shillings. The remainder, being 10 shillings, is to be reduced to pence; and there being 12 pence in a shilling, I multiply 10 by 12, and the product is 120 pence. I then add the 8 pence of the dividend, and it makes 128 pence. I then divide again. 16 in 128 is 8 times. Set down 8 in the quotient, in the place of pence. After multiplying and subtracting, I find there is no remainder, and I have divided the last denomination. So the answer is 1*l.* 18*s.* 8*d.*

EXAMPLE 2.

	lb.	*oz.*	*dwt.*	*gr.*	
*Dr.*7)23	7	6	12,	*Dd.*
Qt.	3	4	9	12	

EXAMPLE 3.

	lb.	*oz.*	*dr.*	*sc.*	*gr.*
12)13	1	2	0	0	
	1	1	0	2	10

EXAMPLE 4.

	yd.	*qr.*	*na.*
47)571	2	1	
	12	0	2+

RULE 2.

Reduce the dividend to the lowest denomination of which it consists, and then divide as in simple division; reducing the answer, when found, to a higher denomination, if required.

Example.

Divide 30*l.* 18s. 8*d.* by 16.

Work. I first reduce the 30*l.* 18s. 8*d.* to pence, and find it to be 7424 pence. I then divide 7424 by 16, and find the quotient to be 464, which is 464 pence. I then reduce 464 pence to pounds, and have 1*l.* 18s. 8*d.* for the answer.

Questions on the foregoing.

What is Reduction?
By what other rules is it performed?
When the reduction is from a higher denomination to a lower, how is it performed?
When from a lower to a higher, how is it performed?
What is Compound Addition?
How does it differ from Simple Addition?
How are the numbers to be written down?
Which column is to be added first?
What is to be done with its sum?
For how many of one denomination must you carry 1 to the next higher?
What is Compound Subtraction?
How does it differ from Simple Subtraction?
How are the numbers to be written down?
What is to be done when the lower number is greater than that above it?
What is Compound Multiplication?
How does it differ from Simple Multiplication?
How must the numbers be placed?
Where do you begin to multiply?
What must be done with that product?
For how many in the product of a lower denomination do you carry 1 to the product of a higher?
What is the second rule?
What is Compound Division?
How does it differ from Simple Division?
How are the dividend and divisor to be placed?
Where do you begin to divide?
When you have divided a higher denomination, what do you do with the remainder?
What do you do next?
What is the second rule?

Exercise 23.

From	take,	and tell the	*Ans.*	From	take,	and tell the	*Ans.*
97,	25,	twelfth,	6	87,	15,	eighth,	9
101,	26,	fifteenth,	5	112,	40,	third,	22
89,	26,	ninth,	7	28,	7,	seventh,	3
67,	12,	fifth,	11	89,	25,	eighth,	8
53,	13,	fourth,	10	27,	3,	eighth,	3
65,	11,	sixth,	9	38,	11,	third,	9
74,	11,	ninth,	7	44,	8,	sixth,	6
29,	2,	third,	9	57,	12,	third,	15
36,	8,	fourth,	7	48,	13,	fifth,	7
103,	49,	sixth,	9	59,	11,	sixth,	8
96,	12,	twelfth,	7	63,	9,	ninth,	6

Exercise 24.

Tell what is the	*Ans.*	Tell what is the	*Ans.*
3d of a half of 18,	3	3d of a 5th of 45,	3
4th of a 3d of 24,	2	5th of a half of 50,	5
3d of a half of 36,	6	5th of a half of 20,	2
half of a 3d of 24,	4	3d of a 6th of 36,	2
3d of a 4th of 48,	4	4th of a 5th of 40,	2
4th of a half of 40,	5	4th of a 3d of 48,	4
3d of a 3d of 27,	3	3d of a 12th of 72,	2
4th of a 3d of 36,	3	half of a 12th of 96,	4
3d of a 4th of 60,	5	5th of an 8th of 80,	2
5th of a half of 30,	3	4th of a 4th of 48,	3
6th of a 3d of 72,	4	3d of a 3d of 36,	4

Exercise 25.

Tell what is the	*Ans.*	Tell what is the	*Ans.*
4th of a 5th of 40,	2	3d of an 8th of 96,	4
3d of a 6th of 72,	4	8th of a 3d of 72,	3
5th of a half of 60,	6	4th of a 6th of 120,	5
3d of a 6th of 54,	3	5th of a 7th of 105,	3
4th of a 5th of 100,	5	8th of a 9th of 360,	5
5th of a 6th of 120,	4	3d of a 7th of 63,	3
3d of an 8th of 72,	3	4th of an 8th of 96,	3
half of a 9th of 36,	2	8th of a 3d of 120,	5
3d of a 7th of 42,	2	4th of a 4th of 160,	10
5th of a 4th of 60,	3	5th of a 3d of 90,	6
6th of a 7th of 84,	2	4th of a 7th of 140,	5

Exercise 26.

Tell what is	*Ans.*	Tell what is	*Ans.*
2 fifths of 25,	10	9 tenths of 90,	81
3 fifths of 35,	21	7 eighths of 56,	49
4 fifths of 75,	60	3 sevenths of 42,	18
3 sevenths of 21,	9	4 fifths of 55,	44
2 ninths of 45,	10	3 eighths of 40,	15
6 sevenths of 42,	36	3 fifths of 60,	36
5 eighths of 64,	40	4 sevenths of 56,	32
7 eighths of 96,	84	6 sevenths of 49,	42
6 sevenths of 35,	30	5 ninths of 72,	40
6 sevenths of 49,	35	4 fifths of 60,	48
5 ninths of 45,	30	7 eighths of 64,	56

Exercise 27.

Tell what is			*Ans.*	Tell what is			*Ans.*
3 times	5 times	11,	165	6 times	3 times	2,	36
4	6	12,	288	8	3	7,	168
5	6	10,	300	9	4	5,	180
5	6	9,	270	7	5	3,	105
6	7	8,	336	6	6	3,	108
6	7	4,	168	2	5	11,	110
7	5	2,	70	3	6	12,	216
6	6	2,	72	4	6	10,	240
4	9	8,	288	3	4	9,	108
3	9	7,	189	5	4	8,	160
2	6	4,	48	3	5	12,	180

Exercise 28.

Tell what is			*Ans.*	Tell what is			*Ans.*
7 times	3 times	3,	63	6 times	8 times	7,	336
8	4	2,	64	3	6	7,	126
6	3	4,	72	4	7	3,	84
7	5	2,	70	5	9	4,	180
4	5	6,	120	4	4	4,	64
5	6	7,	210	5	5	5,	125
6	7	8,	336	6	6	6,	216
7	8	9,	504	3	4	11,	132
3	8	9,	216	4	5	12,	240
4	7	8,	224	6	7	4,	168
5	8	9,	360	5	8	3,	120

Exercise 29.

Tell what is		*Ans.*	Tell what is		*Ans.*
5 times	25,	125	3 times	39,	117
4	26,	104	4	49,	196
2	84,	168	5	59,	295
3	17,	51	6	61,	366
4	19,	76	7	14,	98
5	16,	80	3	16,	48
6	14,	84	4	18,	72
7	13,	91	5	17,	85
8	15,	120	6	13,	78
9	21,	189	7	17,	119
2	29,	58	8	18,	144

Exercise 30.

From	take,	*Ans.*	From	take,	*Ans*
20,	2 thirds of 18,	8	18,	6 sevenths of 14,	6
18,	3 fourths of 12,	9	29,	8 ninths of 27,	5
16,	2 fifths of 25,	6	17,	5 sixths of 12,	7
17,	3 sevenths of 28,	5	31,	6 sevenths of 21,	13
21,	4 fifths of 15,	9	24,	9 tenths of 20,	6
30,	5 sixths of 18,	15	27,	3 fifths of 25,	12
32,	2 thirds of 21,	18	18,	3 sevenths of 14,	12
28,	6 sevenths of 14,	16	23,	3 eighths of 24,	14
12,	3 fourths of 8,	6	26,	4 ninths of 27,	14
14,	5 eighths of 16,	4	19,	5 sevenths of 21,	4

Exercise 31.

From	take,	*Ans.*	From	take,	*Ans.*
40,	6 sevenths of 42,	4	32,	3 fifths of 40,	8
50,	5 eighths of 64,	10	80,	6 sevenths of 70,	20
90,	7 eighths of 96,	6	75,	5 eighths of 96,	15
36,	6 sevenths of 35,	6	39,	8 ninths of 36,	7
40,	6 ninths of 45,	10	47,	5 sixths of 42,	12
50,	4 fifths of 60,	2	26,	3 fifths of 40,	2
36,	3 sevenths of 42,	18	31,	4 fifths of 35,	3
26,	9 tenths of 20,	8	42,	4 ninths of 36,	26
45,	3 elevenths of 55,	30	57,	5 twelfths of 96,	17
35,	6 sevenths of 28,	11	39,	3 eighths of 48,	21

Note. The author of this work is of the opinion, that the most scientific arrangement of the several rules, requires Fractions to precede the Rule of Three, and the other rules which usually follow that. But if any instructor should think it most for the advantage of particular pupils to attend to those rules before Fractions, he can direct them to pass on accordingly, and omit those parts of them in which fractions are used.

VULGAR FRACTIONS.

A fraction is an expression for the part or parts of a quantity, which quantity is denoted by unity.

A vulgar fraction is denoted by two numbers, one placed above another, with a line between them.

The number placed below the line is called the denominator, and that above it the numerator, and both are called terms.

The denominator shows how many equal parts the unit or quantity is divided into; and the numerator shows how many of those parts are taken.

Thus, if a pound sterling is divided into 20 equal parts or shillings, and 5 of those parts, or 5 shillings, are given to A, 7 to B, and 8 to C, the share of each, expressed in the manner of a vulgar fraction, is, A's, $\frac{5}{20}$ of a pound; B's, $\frac{7}{20}$ of a pound; and C's, $\frac{8}{20}$ of a pound.*

The denominator represents the divisor, in division, and the numerator the remainder.

A proper fraction, is one of which the numerator is less than the denominator, as $\frac{1}{2}$, or $\frac{2}{3}$.

An improper fraction, is one of which the numerator is equal to, or greater than the denominator, as $\frac{3}{3}$, or $\frac{7}{5}$.

A single fraction, is a simple expression for any number of the parts of a unit, as $\frac{3}{5}$.

A compound fraction, is the fraction of a fraction, as $\frac{1}{2}$ of $\frac{2}{3}$.

A mixed number, is composed of a whole number and a fraction together, as $3\frac{1}{4}$.

A whole number may be expressed like a fraction, by writing 1 under it for a denominator, as $\frac{3}{1}$, which is the same as 3.

A common measure of two or more numbers, is that number which will divide each of them without a remainder.

A common multiple of two or more numbers, is that number which can be divided by each of them without a remainder.

Problem 1.

To find the greatest common measure of two or more numbers.

Rule.

1. If there are two numbers only, divide the greater by the less, then divide the divisor by the remainder; and so on, dividing always the last divisor by the last remainder, till nothing remains; and the last divisor will be the greatest common measure sought.

2. If there are more than two numbers, find the greatest common measure of two of them, as before; then do the same for that common measure and another of the numbers; and so on, through all the numbers; and the greatest common measure last found, will be the answer.

* The denominator, instead of being put under the numerator, is sometimes written after it, separated by a hyphen, thus, 1-2 *one half*, 3-4 *three fourths*, 10-20 *ten twentieths*.

Note. If it happens that the common measure thus found is 1, the numbers are said to be incommensurable, or not having any common measure.

EXAMPLE.

What is the greatest common measure of 336, 720, and 1736?

Operation. First, I take 336 and 720, and find the greatest common measure of these, as follows:

336)720(2
672
---
48)336(7
336

Having divided 720 by 336, I find 48 remainder; and having divided the last divisor 336, by this remainder 48, I find no remainder; consequently 48 is the greatest common measure of 336 and 720.

Next, I am to find the greatest common measure of 48 and the third given number, 1736; and I proceed in the same way.

48)1736(36
144

296
288
---
8)48(6
48

Here, having divided 1736 by 48, I find 8 remainder; and having divided 48 by this, I find no remainder; consequently 8 is the greatest common measure of 336, 720, and 1736.

PROBLEM 2.

To find the least common multiple of two or more numbers.

RULE.

1. Divide by any number that will divide two or more of the given numbers without a remainder, and set down the quotients and the numbers not divided in a line below.

2. Divide the second line in the same manner; and so on, till there are no two numbers that can be divided without a remainder.

3. Multiply the numbers in the lower line and the several divisors continually together, and the product will be the least common multiple required.

EXAMPLE.

What is the least common multiple of 3, 4, 8, and 12?

Operation.

4)3, 4, 8, 12
---
3)3, 1, 2, 3

1, 1, 2, 1

Here, first, I perceive that 4 will divide three of the numbers, to wit, 4, 8, and 12, without a remainder. I therefore divide them by 4, and set down their quotients, 1, 2, and 3, under them respectively, and 3, the number not divided, in the same

[illegible]

I perceive that 3 will divide two of the numbers, to wit, 8 and 3, without a remainder. Accordingly, I divide them, and set down their quotients, and the numbers not divided, as before; and the third line is 1, 1, 2, 1, which being multiplied together, and by the divisors, 4 and 3, gives 24, as the answer.

REDUCTION OF VULGAR FRACTIONS.

Case 1.

To reduce a fraction to its lowest terms.

Rule.

Divide both terms of the fraction by any number which will divide both without a remainder, and those quotients again in like manner; and so on, till you can proceed no further, and the last quotients will be the fraction in its lowest terms.

Or: Find the greatest common measure of the two terms, and divide them both by it, and the quotients will be the fraction in its lowest terms.

Example.

Reduce $\frac{182}{196}$ to its lowest terms.

Operation.

$$\begin{array}{r} 7) \\ 2) \end{array} \frac{182}{196} = \frac{91}{98} = \frac{13}{14}$$ *Ans.*

Here, I first divide both terms by 2, and it gives $\frac{91}{98}$, and these I divide again by 7, and it gives $\frac{13}{14}$, which I cannot divide again; and consequently $\frac{13}{14}$ is the answer.

Case 2.

To reduce fractions of different denominators to other fractions of the same value, having a common denominator.

Rule.

Multiply each numerator into all the denominators except its own, for the new numerators; and all the denominators together for a common denominator.

Example.

Reduce $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{3}{4}$, to a common denominator.

Operation.

$1\times3\times4=12$ } the new
$2\times2\times4=16$ } numera-
$3\times2\times3=18$ } tors.

$2\times3\times4=24$ new denominator.

Here, I take 1, the numerator of the first fraction, and multiply it by 3, and 4, the denominators of the second and third fractions, and it gives 12, for the new numerator of the first fraction.

Then, I take 2, the numerator of the second fraction, and multiply it by 2 and 4, the denominators of the first and third fractions, and it gives 16 for the new numerator of the second fraction.

Then I take 3, the numerator of the third fraction, and multiply it by 2 and 3, the denominators of the first and second fractions, and it gives 18 for the new numerator of the third fraction.

Lastly, I take 2, 3, and 4, the denominators, and multiply them together, and it gives 24 for the new denominator; and the new fractions are $\frac{12}{24}$, $\frac{16}{24}$, and $\frac{18}{24}$.

Note. When the denominator of one fraction is a multiple of the denominator of another, they may be reduced to the same denominator, by multiplying both the terms of that fraction whose denominator is the smaller, by such number as will make its denominator equal to that of the other.

EXAMPLE.

Reduce $\frac{3}{4}$ and $\frac{5}{12}$ to a common denominator.

Operation. Here, 12, the denominator of one fraction, is 3 times 4, the denominator of the other. Therefore, $\frac{3}{4}$ may have both its terms multiplied by 3. Now, 3 times 3 is 9; and 3 times 4 is 12. Therefore $\frac{9}{12}$ is equal to $\frac{3}{4}$, and its denominator is the same as that of $\frac{5}{12}$, the other fraction. So that $\frac{9}{12}$ and $\frac{5}{12}$ are the fractions, having the same denominator.

This method will sometimes very much shorten operations in addition and subtraction of vulgar fractions.

CASE 3.

To reduce a mixed number to its equivalent improper fraction.

RULE.

Multiply the whole number by the denominator of the fraction, and add the numerator to the product, and this will be the numerator, under which write the denominator, and it will be the improper fraction required.

EXAMPLE.

Reduce $23\frac{2}{3}$ to an improper fraction.

Here, I first multiply 23, the whole number, by 3, the denominator of the fraction, and it gives 69, to which I add 2, the numerator of the fraction, and it makes 71, for the new numerator, under which I write 3, the denominator; and $\frac{71}{3}$ is the improper fraction required.

CASE 4.

To reduce an improper fraction to its equivalent whole or mixed number.

RULE.

Divide the numerator by the denominator, and the quotient will be the whole or mixed number sought.

EXAMPLES.

Reduce $\frac{71}{3}$ to its equivalent mixed number.

3)71

$23\frac{2}{3}$ *Ans.*

Reduce $\frac{56}{7}$ to its equivalent whole number.

7)56

8 *Ans.*

CASE 5.

To reduce a compound fraction to an equivalent single one.

RULE.

Multiply all the numerators together for a numerator, and all the denominators together for a denominator; and they will form the single fraction required, which reduce to its lowest terms.

Note. This operation may frequently be contracted. When the same number is both among the numerators and the denominators, it may be struck out of both. When a number in one set of terms will divide, without a remainder, any number in the other set of terms, the quotient may be substituted for the dividend, and the divisor be struck out. Or, when one in each set of terms can be divided by the same number without a remainder, the quotients may be substituted in their stead.

EXAMPE.

Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{5}{6}$ of $\frac{6}{7}$, to a single fraction.

Operation. I first multiply all the numerators, 2, 3, 4, 5, 6, together, for a new numerator, and it is found to be 720; and then I multiply all the denominators, 3, 4, 5, 6, 7, together, for a new denominator, and it is found to be 2520. And the single fraction required is $\frac{720}{2520}$, which reduced to its lowest terms, is $\frac{2}{7}$, which is the answer.

CONTRACTION.

This operation may be contracted, by striking out those figures which are the same in both sets of terms, and which, in the following example, are marked with an asterisk:

$$\frac{2}{3} \text{ of } \frac{\overset{*}{3}}{4} \text{ of } \frac{\overset{*}{4}}{5} \text{ of } \frac{\overset{*}{5}}{6} \text{ of } \frac{\overset{*}{6}}{7},$$

Where all the numerators are struck out, except the 2, and all the denominators, except the 7; and the answer is, as before, $\frac{2}{7}$, without any [illegible]

Note. The reasons for this contraction are, that when any number is multiplied by another, and afterwards divided by the same, it is brought back to what it was: and in a compound fraction, the upper set of terms are multipliers, and the lower set of terms are divisors. So that, in the above example, if you take 2, the first of the upper terms, and multiply it by 3, the second, it makes 6: but you afterwards have to divide it again by 3, which brings it back to 2, as it was. Both the multiplication by 3. and the division by 3, may therefore be omitted, and the two 3's struck out. And so of the rest.

Case 6.

To reduce a fraction from one denomination to another.

Rule.

Consider how many of the less denomination make one of the greater: then, if the reduction is to a lower denomination, multiply the numerator by that number; if to a higher, multiply the denominator; and then reduce the fraction so formed to its lowest terms.

Example 1.

Reduce $\frac{2}{9}$ of a pound to the fraction of a penny.

Operation. Here, I consider that 240 pence make a pound; and as the reduction is to a lower denomination, I multiply the numerator by it, and it is, 2 times 240, that is 480, which is the numerator of the fraction, and 9 is the denominator: and $\frac{480}{9}$, being reduced to its lowest terms, is $\frac{160}{3}$, which is the answer.

Example 2.

Reduce $\frac{5}{6}$ of a penny to the fraction of a pound.

Operation. Here, I consider that 240 pence make a pound; and as the reduction is to a higher denomination, I multiply the denominator by it, and it is 6 times 240, that is 1440, which is the denominator of the fraction, and 5 is the numerator; and $\frac{5}{1440}$, being reduced, is $\frac{1}{288}$, which is the answer.

Case 7.

To find the value of a fraction of a higher denomination, in whole numbers of a lower.

Rule.

Consider how many of the lower denomination make one of the higher; multiply the numerator by these, and divide by the denominator.

Example.

What is the value of $\frac{2}{3}$ of a pound?

Operation. Here, I consider that 20 shillings make a pound; so I multiply 2, the numerator, by 20, and it makes 40, which I divide by 3, the denominator, and it gives 13 shillings and $\frac{1}{3}$. Again, I consider that 12 pence make 1

shilling; so I multiply 1, the numerator of this fraction, b 12, and it makes 12, which I divide by 3, the denominato and it gives 4 pence. And the answer is 13s. 4d.

CASE 8.

To reduce any given value or quantity in a lower denom nation, to the fraction of a higher.

RULE.

Reduce the given quantity to the lowest name in it, for numerator, and one of the higher denomination to the san name, for a denominator, which reduce to its lowest terms.

EXAMPLE.

Reduce 2 feet, 8 inches, $1\frac{1}{5}$ barley corns, to the fraction a yard.

Operation. Here, I am first to reduce this quantity to t lowest name in it, which is the fifth of a barley corn, for numerator; and then to reduce a yard to fifths of a barl corn, for a denominator; which is done as follows:

ft. in. b. c.	
2 .. 8 .. $1\frac{1}{5}$	1 yard,
12	3
—	—
32 inches,	3 feet,
3	12
—	—
97 barley corns,	36 inches,
5	3
—	—
486 fifths of a *b. c.*	108 barley corns,
numerator.	5
	—
	540 fifths of *b. c.*, *denominato*

And the fraction is $\frac{486}{540}$, which being reduced to its lowe terms, is $\frac{9}{10}$, which is the answer.

ADDITION OF VULGAR FRACTIONS.

RULE.

Reduce compound fractions to single ones, mixed nu bers to improper fractions, those of different denominatio to the same denomination, and all to a common denomin tor; and the sum of the numerators, being written over t common denominator, and that fraction reduced to its lowe terms, will give the answer.

EXAMPLE.

Add $\frac{3}{5}$, $\frac{4}{5}$ of $\frac{1}{3}$, and $9\frac{3}{20}$, together.

Operation. Here, I first reduce the compound fraction, $\frac{4}{5}$ of $\frac{1}{3}$, to a single one, and it makes $\frac{4}{15}$. I then reduce the mixed number, $9\frac{3}{20}$, to an improper fraction, and it makes $\frac{183}{20}$ And the question stands, $\frac{3}{5}+\frac{4}{15}+\frac{183}{20}$.

Next, I reduce these 3 fractions to a common denominator, and they are $\frac{900}{1500}+\frac{400}{1500}+\frac{13725}{1500}$. They are now prepared for addition, and the sum of the numerators is found to be 15025, which being written over the common denominator, is $\frac{15025}{1500}$, and this reduced to its lowest terms, is $10\frac{1}{60}$, which is the answer.

SUBTRACTION OF VULGAR FRACTIONS.

RULE.

Prepare the fractions as in addition, and subtract the numerator of the less from that of the greater; and the difference placed over the common denominator, and that fraction reduced to its lowest terms, will be the answer.

EXAMPLE.

From $14\frac{1}{4}$, take $\frac{2}{3}$ of 19.

Operation. Here, the greater number, $14\frac{1}{4}$, is a mixed number, and is to be reduced to an improper fraction, which being done, it is $\frac{57}{4}$. The less number, $\frac{2}{3}$ of 19, is a compound fraction, and is to be reduced to a single fraction, which being done, it is $\frac{38}{3}$. The question then becomes this, from $\frac{57}{4}$ take $\frac{38}{3}$. The next thing to be done, is to reduce these two fractions to a common denominator, which being done, they are $\frac{171}{12}$ and $\frac{152}{12}$; and the question becomes this, from $\frac{171}{12}$ take $\frac{152}{12}$; and 152, the numerator of the less, being taken from 171, the numerator of the greater, leaves 19, which being placed over the common denominator, is $\frac{19}{12}$, and this reduced to its lowest terms. is $1\frac{7}{12}$, which is the answer.

MULTIPLICATION OF VULGAR FRACTIONS.

RULE.

Reduce compound fractions to single ones, mixed numbers to improper fractions, and those of different denominations to the same denomination; then multiply the numerators together for a new numerator, and the denominators together for a new denominator, and reduce it to its lowest terms.

EXAMPLE.

Multiply $12\frac{3}{5}$ by $\frac{1}{3}$ of 7.

Operation. Here, the first is a mixed number, and is to be reduced to an improper fraction, which being done, it is $\frac{63}{5}$. The second number is a compound fraction, and is to be reduced to a single one, which being done, it is $\frac{7}{3}$. The numerators 63 and 7, being multiplied together, give 441 for a new numerator; and the denominators 5 and 3, being multiplied together, give 15 for a new denominator; and the product is $\frac{441}{15}$, which being reduced, is $14\frac{7}{5}$, or $29\frac{2}{5}$, which is the answer.

DIVISION OF VULGAR FRACTIONS.

RULE.

Prepare the fraction as in multiplication; invert the terms of the divisor, and proceed as in multiplication.

EXAMPLE.

Divide $4\frac{5}{9}$ by $\frac{5}{9}$ of 4.

Operation. Here, the dividend is a mixed number, and is to be reduced to an improper fraction, which being done, it is $9\frac{41}{6}$. The divisor is a compound fraction, and is to be reduced to a single one, which being done, it is $\frac{20}{9}$. Now, $\frac{41}{9}$ divided by $\frac{20}{9}$, is the same as $\frac{41}{9}$ multiplied by $\frac{9}{20}$, the terms of the divisor being inverted. And $\frac{41}{9}$ multiplied by $\frac{9}{20}$, is $\frac{369}{180}$, which, being reduced, is $2\frac{1}{20}$, which is the answer.

QUESTIONS ON THE FOREGOING.

What is a fraction?
What is a vulgar fraction?
What is the denominator?
What is the numerator?
What are they both called?
What does the denominator show?
What does the numerator show?
What does each represent?
What is a proper fraction?
What is an improper fraction?
What is a single fraction?
What is a compound fraction?
What is a mixed number?
How may a whole number be expressed like a fraction?
What is meant by a common measure?
What by a common multiple?
How do you find the greatest common measure of two numbers?
How of more than two?
How do you find the least common multiple?
How do you reduce a fraction to its lowest terms?
How do you reduce fractions to a common denominator?
How do you reduce a mixed number to an improper fraction?
How do you reduce an improper fraction to a whole or mixed number?
How do you reduce a compound fraction to a single one?
How may this operation be contracted?

How do you reduce a fraction from a higher denomination to a lower?
How from a lower to a higher?
How do you find the value of a fraction of a higher denomination in whole numbers in a lower?
How do you reduce a given value or quantity to the fraction of a higher denomination?
What is the rule for the addition of vulgar fractions? For subtraction? multiplication? division?

DECIMAL FRACTIONS.

When the denominator of a vulgar fraction is 1, with any number of cyphers annexed, as 10, 100, 1000, &c. it is called a decimal fraction; and instead of writing the denominator under the numerator, the numerator only is set down, with a point at the left hand of it; thus, $\frac{5}{10}$ is written ·5, $\frac{25}{100}$ is written ·25, and $\frac{375}{1000}$ is written ·375. But if the numerator has not as many places as there are cyphers in the denominator, cyphers must be prefixed to make up that number; as, $\frac{75}{1000}$, must be written ·075, and $\frac{124}{100000}$ must be written ·00124.

Cyphers at the right hand of decimals make no alteration in their value; for, ·5, and ·50, and ·500, are decimals of the same value, and signify 5 tenths, or 50 hundredths, or 500 thousandths. But if cyphers are placed on the left hand of the significant figures, and after the decimal point, they decrease the value of those figures in a tenfold proportion; thus, ·5 is $\frac{5}{10}$, but ·05 is only $\frac{5}{100}$, and ·005 is $\frac{5}{1000}$.

In numerating decimals, begin at the decimal point, and proceed towards the right hand. The first place is tenths, the second hundredths, the third thousandths, the fourth ten thousandths, the fifth hundred thousandths, the sixth millionths, and so on. The numeration of decimals and of whole numbers is similar, only that whole numbers proceed from right to left, and decimals proceed from left to right.

Read, in words, the following decimals:

.6	·05	·1
·26	·005	·11
·845	·065	·01
·42	·00078	·001
·257	·0708	·0101
·3567	·02567	·01101
·467	·00001	·10101
·3506	·00011	·11011
·9	·00026	·011011
·98	·00678	·1010101
·9876	·002789	·010101
·67	·0102034	·011001

Write down in figures the following decimals:

Thirty-four *hundredths.*
Four hundred and sixty-one *thousandths.*
Five thousand and eleven *ten thousandths.*
Seven *tenths.*
Eight *thousandths.*
Nine *hundredths.*
Twenty-eight *ten thousandths.*
Sixty-eight *millionths.*
One *thousandth.*
One hundred and one *millionths.*
One thousand one hundred and one *ten thousandths.*
Two hundred and thirty-four thousand three hundred and five *millionths.*
One hundred and one thousand and one *ten thousandths.*
One thousand one hundred and one *millionths.*
One *ten millionth.*
One hundred and one *ten thousandths.*
Twenty-one *ten millionths.*
One *hundred thousandth.*
One *millionth.*

A mixed number is made up of a whole number and some decimal fraction, the one being separated from the other by the decimal point, hence called the *separatrix.* Thus, 123·4, is one hundred and twenty-three, and four tenths; 12·34, is twelve, and thirty-four hundredths; 1·234, is one, and two hundred and thirty-four thousandths.

Note. In stating results, after operations have been performed, it has been found more perspicuous to write the denominator under, in the manner of a vulgar fraction.

ADDITION OF DECIMALS.

Rule.

Place the numbers so that the decimal points shall stand exactly under each other, and then proceed as in addition of whole numbers, putting the decimal point in the sum exactly under those in the numbers added.

Example.

What is the sum of 450+31·47+376·004+1·08+456+·76 +·05?

Operation.
450·
31·47
376·004
1·08
456·
·76
·05
———
1315·304 *Ans.*

Here, I first set down the 450; and as this is a whole number, I put the decimal point after it. Next, I set down the 31·47, so that the decimal point in it stands under the other decimal point, and 1, the unit of the whole number, stands under 0, the unit of the first whole number; and 4, the first decimal, occupies the first place of decimals. In like manner, all the rest are set down, and added according to the rule.

SUBTRACTION OF DECIMALS.

Rule.

Place the less number under the greater, so that the decimal points shall be one under the other, and proceed as in whole numbers, only putting the decimal point in the remainder under those of the other numbers.

Example.

What is the difference between 100·17 and 84·476?

Operation.
From 100·17
Take 84·476
———
Rem. 15·694 *Ans.*

Note. As there is no figure above the 6, from which to subtract, you must suppose a cypher.

MULTIPLICATION OF DECIMALS.

Rule.

Proceed as in whole numbers, only point off, in the product, as many decimal places as there are in both multiplicand and multiplier together.

Example.

Multiply ·00345 by ·25.

Operation.
·00345
·25
———
1725
690
———
·0008625 *Ans.*

Here, I multiply the significant figures 345 by 25, and get 8625 for the figures of the product; but as there were five decimal places in the multiplicand, and two in the multiplier, there must be seven in the product; so I prefix three cyphers to make up the number.

DIVISION OF DECIMALS.

RULE.

Divide as in whole numbers, and point off as many places for decimals as the decimal places in the dividend exceed those in the divisor.

Note. When there is a remainder after division, or when the decimal places of the dividend are not so many as those of the divisor, then annex cyphers to the dividend, and carry on the operation as far of shall be thought requisite.

EXAMPLE.

Divide ·0008625 by ·00345.

Operation.

·00345)·0008625(·25
690 *Ans.*
—
1725
1725

Here, I divide 8625, the significant figures of the dividend, by 345, the significant figures of the divisor, and get 25 for the figures of the quotient. To know whether these are decimals or not, I count the decimal places of the divisor, and find them five; and then count the decimal places of the dividend, and find them seven, that is, two more than those of the divisor. There must, therefore, be two decimal places in the quotient, and I place the point before 25 accordingly.

REDUCTION OF DECIMALS.

CASE 1.

To reduce a vulgar fraction to its equivalent decimal.

RULE.

Divide the numerator by the denominator, annexing as many cyphers as may be necessary, and the quotient will be the decimal required.

EXAMPLE.

Reduce $\frac{3}{4}$ to its equivalent decimal.

Operation.

4)3·0(·75 *Ans.*
28
—
20
20

Here, as I cannot divide 3 by 4, I annex a cypher to the 3, and it makes 30, and say, 4 in 30, 7 times, and 2 remains. Again, I annex a cypher to the 2, and it makes 20, and say, 4 in 20, 5 times, and nothing remains. The quotient, then, is 75. And as I annexed two cyphers, or decimal places to the 3, and there were no decimals in the divisor, I point off two decimals in the quotient, and the answer is ·75.

CASE 2.

To reduce a quantity consisting of different denominations, to its equivalent decimal value.

RULE 1.

Write the given numbers in order, from the lowest denomination to the highest, in a perpendicular column, and divide each of them by as many units as it takes of that denomination to make one of the next higher. Set down the quotient of each division, as decimal parts, on the right hand of the dividend next below it, and the last quotient will be the decimal required.

EXAMPLE 1.

Reduce 15*s.* 9¾*d.* to the decimal of a pound.

Operation.

4)3· *q.*
12)9·75 *d.*
20)15·8125 *s.*
·790625 £. *Ans.*

Here, I set down, in a perpendicular column, 3 farthings, 9 pence, and 15 shillings. Next, as 4 farthings make 1 penny, I divide the 3 by 4, and it makes ·75*d.*, which I set down at the right hand of 9*d.* the next dividend. Next, as 12 pence make 1 shilling, I divide 9·75*d.* by 12, and it makes ·8125*s.*, which I set down at the right hand of the 15*s.* Then, as 20 shillings make 1 pound, I divide 15·8125*s.* by 20, and it makes ·790625£., which is the answer.

EXAMPLE 2.

Reduce 3*qrs.* 12*lb.* 6*oz.* 14·592 *drams*, to the decimal of a *Cwt.*

Operation.

16 { 4)14·592 *dr.*
4)[3·648]
16 { 4) 6·912 *oz.*
4)[1·728]
28 { 4)12·432 *lb.*
7)[3·108]
4) 3·444 *qrs.*
·861 *Cwt.*
Ans.

Here, I set down, as before, 14·592*dr.* 6*oz.* 12*lb.* and 3 *qrs.* in a column, with a little space between them. Next, because 16 drams make an ounce, I am to divide 14·592*dr.* by 16; but since 4×4 is 16, if I divide by 4, and that quotient again by 4, it will be the same as dividing by 16, and will be more convenient. So, I divide 14·592 by 4, and the quotient is 3·648, which I set down under the drams, enclosing it in brackets, for the sake of distinction; and then divide that quotient, 3·648, again by 4, and it makes ·912*oz.*, which I set down at the right hand of the 6*oz.* In like manner, I proceed throughout; and the answer is ·861 *Cwt.*

RULE 2.

Reduce the whole quantity to the lowest denomination of which it consists, for a numerator; and reduce one of that denomination in which you wish your answer to be, to the same, for a denominator; and then reduce this fraction to a decimal, according to Case 1.

EXAMPLE.

Reduce 15*s.* 6*d.* to the decimal of a £.

Operation.

15*s.* 6*d.*	1£.
12	20
186 *d.* numerator.	20 *s.*
	12
	240 *d.* denominator.

And the fraction is $\frac{186}{240}$ of a £., which is reduced to a decimal as follows:

240)186·0(·775 *Answer.*
1680
1800
1680
1200
1200

CASE 3.

To reduce a decimal fraction to its value, in terms of the lower denominations.

RULE.

Multiply the decimals given, by as many units as it takes of the next lower denomination to make one of the denomination given, and point off as many places for decimals as there are in the multiplicand; the rest will be whole numbers of that lower denomination.

EXAMPLE.

Reduce ·775 of a £. to its value.

Operation.

·775
20
s. 15·500
12
d. 6·000

Here, I first multiply ·775 by 20, because there are 20*s.* in a £., and the product is 15·500, the three last figures being decimals, because there were three decimals in ·775, the multiplicand; and the other two figures, to wit, 15, are so many shillings. Next, I multiply the decimals of this product, to wit, ·500, by 12, because there are 12 pence in a shilling; and the product is 6·000,

of which the 6 is 6 pence; and there being no more decimals to reduce further, the work is done, and the answer is 15*s.* 6*d.*

Questions on the foregoing.

What is a decimal fraction?
In what manner are decimal fractions written?
What effect have cyphers placed at the right or left hand of the significant figures of a decimal?
In numerating decimals, where do you begin?
Which way do you proceed?
What is the value of the first place? The second? third? fourth? fifth? sixth?
What difference is there in the numeration of whole numbers and of decimals?
What is a mixed number, in decimal fractions?
What is the separatrix?
In what manner are results usually stated?
Why are they so written?
What is the rule for the addition of decimals? For subtraction? multiplication? division?
How do you reduce a vulgar fraction to a decimal?
How do you reduce a quantity of different denominations to its decimal value, by the first rule?
How by the second?
How do you reduce a decimal fraction to its value?

Exercise 32.

Tell what is the	*Ans.*	Tell what is the	*Ans.*
half of 2 thirds of 45,	15	7th of 7 eighths of 48,	6
3d of 3 fourths of 60,	15	3d of 3 fourths of 48,	12
4th of 4 fifths of 60,	12	6th of 6 sevenths of 35,	5
5th of 5 sixths of 72,	12	5th of 5 sixths of 48,	8
6th of 6 sevenths of 49,	7	4th of 4 fifths of 55,	11
7th of 7 eighths of 56,	7	6th of 6 sevenths of 56,	8
8th of 8 ninths of 99,	11	4th of 4 fifths of 45,	9
9th of 9 tenths of 100,	10	3d of 3 fourths of 44,	11
8th of 8 ninths of 45,	5	5th of 5 sixths of 42,	7
half of 2 thirds of 36,	12	8th of 8 ninths of 54,	6

Exercise 33.

Tell what is	*Ans.*	Tell what is	*Ans.*
6 fifths of 55,	66	10 thirds of 60,	200
7 thirds of 24,	56	11 fourths of 44,	121
8 thirds of 12,	32	12 thirds of 36,	144
9 thirds of 27,	81	11 fourths of 16,	44
11 fourths of 24,	66	15 thirds of 9,	45
10 sevenths of 77,	110	9 fifths of 55,	99
9 fifths of 25,	45	8 thirds of 18,	48
8 sevenths of 49,	56	10 fourths of 48,	120
9 fifths of 60,	108	12 fifths of 45,	108
9 sevenths of 28,	36	9 sixths of 42,	63

EXERCISE 34.

From	take	*Ans.*	From	take	*Ans.*
35 and 46,	22,	59	22 and 17,	33,	6
24 and 13,	19,	18	21 and 33,	29,	25
33 and 12,	28,	17	37 and 16,	41,	12
37 and 19,	41,	15	24 and 19,	30,	13
26 and 18,	33,	11	19 and 14,	23,	10
19 and 33,	45,	7	87 and 18,	56,	49
21 and 12,	29,	4	73 and 17,	63,	27
69 and 14,	47,	36	61 and 11,	46,	26
53 and 12,	39,	26	54 and 13,	27,	40
44 and 14,	49,	9	69 and 15,	56,	28

EXERCISE 35.

From	take	*Ans.*	From	take	*Ans.*
29,	15 and 6 and 7,	1	63,	25 and 13 and 4,	21
30,	12 and 11 and 3,	4	77,	11 and 5 and 6,	55
32,	5 and 6 and 13,	8	57,	5 and 11 and 12,	29
45,	7 and 8 and 19,	11	46,	6 and 11 and 13,	16
43,	17 and 4 and 11,	11	48,	5 and 7 and 9,	27
19,	7 and 3 and 4,	5	73,	11 and 12 and 6,	44
50,	8 and 5 and 7,	30	64,	9 and 12 and 21,	22
49,	8 and 5 and 13,	23	25,	7 and 6 and 5,	7
70,	10 and 11 and 12,	37	39,	11 and 13 and 5,	10
25,	3 and 7 and 11,	4	28,	7 and 4 and 6,	11

EXERCISE 36.

From	take	*Ans.*	From	take	*Ans.*
45 and 63,	11 and 12,	85	27 and 21,	11 and 7,	30
22 and 37,	13 and 15,	31	33 and 28,	19 and 25,	17
45 and 11,	22 and 13,	21	67 and 31,	47 and 13,	38
77 and 8,	33 and 16,	36	22 and 13,	19 and 12,	4
64 and 13,	11 and 17,	49	74 and 12,	21 and 32,	33
21 and 33,	18 and 9,	27	85 and 11,	37 and 21,	38
46 and 15,	6 and 21,	34	96 and 15,	74 and 25,	12
37 and 17,	19 and 6,	29	87 and 17,	26 and 31,	47
21 and 49,	14 and 27,	29	45 and 52,	13 and 49,	35
43 and 14,	16 and 27,	14	57 and 31,	24 and 19,	45

EXERCISE 37.

Tell what is the	*Ans.*	Tell what is the	*Ans.*
4th of 5 and 8 and 3,	4	4th of 2 and 9 and 1,	3
5th of 7 and 4 and 9,	4	7th of 4 and 8 and 2,	2
7th of 8 and 9 and 4,	3	4th of 6 and 7 and 3,	4

Tell what is the	*Ans.*	Tell what is the	*Ans.*
3d of 5 and 3 and 7,	5	9th of 3 and 11 and 4,	2
4th of 6 and 8 and 2,	4	8th of 5 and 7 and 12,	3
5th of 3 and 10 and 12,	5	6th of 8 and 11 and 5,	4
3d of 4 and 11 and 6,	7	4th of 6 and 7 and 11,	6
6th of 9 and 2 and 7,	3	4th of 7 and 5 and 8,	5
7th of 5 and 9 and 7,	3	6th of 7 and 3 and 2,	2
3d of 1 and 8 and 9,	6	6th of 3 and 11 and 4,	3

EXERCISE 38.

Tell what is the	*Ans*	Tell what is the	*Ans.*
8th of a 12th of 96,	1	4th of a 12th of 240,	5
10th of a 12th of 240,	2	5th of a 10th of 500,	10
8th of an 8th of 128,	2	5th of an 18th of 360,	4
6th of a 6th of 108,	3	4th of a 16th of 320,	5
5th of a 5th of 125,	5	3d of a 10th of 330,	11
12th of a 12th of 288,	2	5th of a 15th of 300,	4
4th of a 20th of 400,	5	4th of a 20th of 800,	10
6th of an 8th of 144,	3	8th of a 10th of 400,	5
5th of a 16th of 320,	4	3d of a 9th of 270,	10
3d of a 15th of 450,	10	3d of an 8th of 240,	10

EXERCISE 39.

Tell what is the	*Ans.*	Tell what is the	*Ans.*
half of 2 thirds of 30,	10	3d of 2 thirds of 45,	10
4th of 4 fifths of 100,	20	4th of 3 fourths of 96,	18
3d of 2 thirds of 72,	16	5th of 3 fifths of 100,	12
half of 2 fifths of 40,	8	7th of 5 sevenths of 49,	5
3d of 3 fifths of 45,	9	12th of 7 eighths of 96,	7
half of 3 fourths of 40,	15	4th of 5 eighths of 64,	10
4th of 3 fourths of 16,	3	3d of 4 fifths of 75,	20
4th of 3 fourths of 48,	9	7th of 3 fifths of 35,	3
6th of 2 thirds of 36,	4	4th of 3 fifths of 60,	9
4th of 3 fifths of 80,	12	8th of 4 sevenths of 56,	4

EXERCISE 40.

Tell what is	*Ans.*	Tell what is	*Ans.*
2 thirds of 3 fourths of 48,	24	3 fifths of 5 sixths of 54,	27
3 fourths of 4 fifths of 20,	12	2 fifths of 5 sevenths of 42,	12
3 fifths of 5 sixths of 30,	15	2 thirds of 3 sevenths of 49,	14
2 thirds of 3 fifths of 45,	18	3 fourths of 4 fifths of 60,	36
3 fourths of 4 fifths of 45,	27	3 fifths of 5 sevenths of 35,	15
2 thirds of 3 fourths of 24,	12	2 sevenths of 7 ninths of 72,	16
2 thirds of 3 fourths of 36,	18	3 sevenths of 7 eighths of 56,	21
4 fifths of 5 sixths of 48,	32	2 ninths of 9 elevenths of 99,	18
5 sixths of 6 sevenths of 28,	20	5 ninths of 9 twelfths of 60,	25
3 fourths of 4 fifths of 35,	21	5 sevenths of 7 eighths of 32,	24

Exercise 41.

Tell what is the	*Ans.*	Tell what is the	*Ans.*
6th of an 8th of 12 times 12,	3	3d of an 8th of 4 times 60,	10
4th of a 20th of 5 times 80,	5	3d of a 7th of 6 times 70,	20
6th of a 6th of 9 times 12,	3	8th of a 3d of 6 times 12,	3
10th of a 12th of 6 times 40,	2	5th of a 4th of 5 times 12,	3
5th of a 16th of 8 times 40,	4	5th of a 6th of 10 times 12,	4
3d of a 15th of 9 times 50,	10	3d of a 6th of 12 times 9,	6
5th of an 18th of 8 times 45,	4	5th of a 7th of 5 times 21,	3
4th of a 16th of 8 times 40,	5	8th of a 9th of 9 times 40,	5
5th of a 15th of 5 times 60,	4	5th of a 6th of 12 times 20,	8
4th of a 10th of 5 times 40,	5	3d of an 8th of 6 times 20,	5

Exercise 42.

Tell what is the	*Ans.*	Tell what is the	*Ans.*
4th of a 5th of 27 and 13,	2	6th of a 7th of 38 and 46,	2
3d of a 6th of 15 and 57,	4	3d of an 8th of 19 and 77,	4
5th of a half of 39 and 21,	6	8th of a 3d of 27 and 45,	3
3d of a 6th of 19 and 35,	3	4th of a 6th of 87 and 33,	5
4th of a 5th of 87 and 13,	5	5th of a 7th of 63 and 42,	3
5th of a 6th of 65 and 55,	4	8th of a 9th of 195 and 165,	5
3d of an 8th of 39 and 33,	3	6th of an 8th of 97 and 47,	3
half of a 9th of 25 and 11,	2	5th of a 5th of 83 and 42,	5
3d of a 7th of 19 and 23,	2	7th of an 8th of 84 and 28,	2
5th of a 4th of 46 and 14,	3	4th of a 5th of 53 and 27,	4

Exercise 43.

Tell what is the	*Ans.*	Tell what is the	*Ans.*
3d of 13 and a 3d of 24,	14	11th of 44 and a half of 56,	32
3d of 27 and a 4th of 98,	16	9th of 63 and a 3d of 96,	39
5th of 35 and a 6th of 43,	15	half of 64 and a 3d of 27,	41
4th of 24 and a 3d of 33,	17	3d of 21 and a 3d of 99,	40
8th of 40 and a 5th of 45,	14	5th of 60 and an 8th of 96,	24
3d of 36 and a 7th of 35,	17	9th of 72 and a 3d of 72,	32
half of 18 and an 8th of 32,	13	8th of 160 and a 3d of 120,	60
5th of 35 and a 9th of 45,	12	9th of 270 and a 5th of 250,	0
7th of 49 and a 6th of 48,	15	8th of 320 and a 7th of 140,	60
8th of 56 and a 3d of 45,	22	half of 150 and a 3d of 45,	90

Exercise 44.

From the	take the	*Ans.*	From	take	*Ans.*
half of 26,	8th of 32,	9	3d of 63,	6th of 54,	12
3d of 27,	9th of 27,	6	4th of 32,	7th of 35,	3
3d of 33,	4th of 32,	3	3d of 27,	8th of 64,	1
4th of 48,	6th of 66,	1	half of 48,	5th of 100,	4
5th of 45,	9th of 36,	5	3d of 69,	4th of 72,	5
6th of 42,	8th of 24,	4	4th of 88,	5th of 45,	13
7th of 28,	8th of 16,	2	5th of 60,	7th of 35,	7
half of 50,	3d of 66,	3	6th of 54,	8th of 48,	3
3d of 66,	6th of 48,	14	7th of 84,	9th of 81,	3
4th of 44,	5th of 40,	3	8th of 96,	12th of 96,	4

Exercise 45.

Tell what is the	multiplied by the	*Ans.*	Tell what is the	multiplied by the	*Ans.*
half of 16,	3d of 21,	56	8th of 48,	7th of 56,	48
4th of 20,	half of 12,	30	4th of 36,	6th of 42,	63
6th of 42,	3d of 9,	21	3d of 33,	9th of 54,	66
7th of 28,	5th of 30,	24	half of 18,	8th of 48,	54
8th of 40,	7th of 35,	25	5th of 25,	half of 24,	84
9th of 45,	3d of 33,	55	8th of 32,	3d of 33,	44
10th of 80,	9th of 27,	24	7th of 21,	4th of 20,	15
12th of 36,	4th of 36,	27	12th of 108,	7th of 21,	27
6th of 54,	8th of 56,	63	3d of 36,	5th of 45,	108
7th of 42,	5th of 35,	42	9th of 63,	6th of 42,	49

Exercise 46.

Tell what is the	divided by the	*Ans.*	Tell what is the	divided by the	*Ans.*
half of 24,	8th of 16,	6	8th of 160,	9th of 45,	4
3d of 36,	4th of 24,	2	5th of 200,	6th of 30,	8
5th of 60,	9th of 27,	4	4th of 120,	7th of 35,	6
4th of 72,	8th of 24,	6	9th of 108,	7th of 28,	3
6th of 48,	9th of 18,	4	3d of 240,	12th of 96,	10
7th of 63,	7th of 21,	3	6th of 96,	11th of 22,	8
7th of 56,	12th of 24,	4	7th of 84,	7th of 21,	4
8th of 96,	9th of 36,	3	9th of 81,	6th of 18,	3
9th of 81,	3d of 9,	3	6th of 72,	9th of 27,	4
6th of 90,	8th of 24,	5	8th of 112,	11th of 22,	7

Exercise 47.

Tell the least common multiple of		Tell the least common multiple of	
2, 3, and 4,	*Ans.* 12	3, 6, and 8,	*Ans.* 24
8, 3, and 2,	24	2, 5, and 6,	30
2, 4, and 6,	12	4, 6, and 9,	36
6, 4, and 10,	60	8, 10, and 4,	40
12, 9, and 6,	36	3, 6, and 9,	18
2, 3, and 9,	18	4, 8, and 6,	24
6, 10, and 20,	60	2, 3, and 6,	12
3, 9, and 15,	45	3, 4, and 8,	24
2, 5, and 10,	20	4, 6, and 3,	12
3, 5, and 6,	30	6, 7, and 3,	42

PROPORTION,

Is the relation which one quantity has to another.

Arithmetical Proportion will be treated of hereafter.

Geometrical Proportion is that relation of two quantities of the same kind, which arises from considering what part the one is of the other, or how often one is contained in the other.

Four quantities are said to be proportional, when the first is the same part or multiple of the second, that the third is of the fourth. Thus, 2, 4, 3, 6, are proportional, because the first is one half the second, and the third is one half the fourth. To denote this proportion, they are written thus :— 2 : 4 : : 3 : 6; that is, as 2 is to 4, so is 3 to 6.

Direct proportion is when one quantity increases in the same proportion as another increases.

Inverse proportion is when one quantity increases in the same proportion as another diminishes.

If four quantities be in geometrical proportion, the product of the two means will be equal to the product of the two extremes. Hence,

If the product of the two means be divided by either extreme, the quotient will be the other extreme; which is the foundation of the following rule.

SIMPLE PROPORTION, OR THE RULE OF THREE,

Is a composition of multiplication and division, which teaches how to find the fourth term of a proportion from three that are given.

1. Observe that two of the given numbers are of the same name, but one greater than the other.

2. Observe that the other given number is of the same name with the number sought.

Rule.

1. Set down for your second or middle term, that number which is of the same name with the answer, or number sought.

2. To know how to place the other two numbers, consider whether the answer should be greater or less than the middle term. If greater, put the greater number at the right hand, for the third term; if less, the less; and put the other number on the left, for the first term.

3. Multiply the second and third terms together, and divide their product by the first; the quotient will be the answer.

Note. If the first and third terms consist of different denominations, reduce them both to the same; and if the middle term is a compound number, reduce it to the lowest denomination mentioned; then the answer will be of the same denomination. If, after division, there is any remainder, and it can be reduced to a lower denomination, reduce it, and divide again, and so on. And if the answer, when found, can be reduced to a higher denomination, reduce it accordingly.

Example 1.

If 7 *Cwt.* 1*qr.* of sugar cost £26 .. 10 .. 4, what will 43 *Cwt.* 2*qr.* cost?

Here, I first consider of what name the answer will be, and conclude it will be pounds, shillings and pence. So I set down £26 .. 10 .. 4, for the second or middle term. Then, to determine where to place the other two terms, I consider whether the answer will be more or less than the middle term. I conclude it must be more, because 43 *Cwt.* will cost more than 7 *Cwt.* So I put 43 *Cwt.* 2*qr.* on the right hand for my third term, and 7 *Cwt.* 1*qr.* on the left, for my first, thus :

First.	Second.	Third.
Cwt. qr.	£ *s.* *d.*	*Cwt. qr.*
7 .. 1 :	26 .. 10 .. 4 : :	43 .. 2

The next thing is to multiply the second and third terms. But, as they consist of different denominations, they must first be reduced to the lowest mentioned, and the first term must also be reduced to the same denomination with the third. This is done as follows :

Cwt. qr.	£ *s.* *d.*	*Cwt. qr.*
7 .. 1	26 .. 10 .. 4	43 .. 2
4	20	4
29 *qrs.*	530 *s.*	174 *qrs.*
	12	
	6364 *d.*	

And the question stands,

qrs.	*d.*	*qrs.*
29 :	6364 : :	174 :

I have now to multiply the second and third terms together, and divide by the first, and the quotient will be the answer in pence.

29 : 6364 : : 174

174

25456
44548
6364

29)1107336(38184

87

237
232

53
29

24

243
232

116
116

The quotient is 38184 pence, which being reduced to pounds, gives £159 .. 2, for the answer.

EXAMPLE 2.

If 48 men can perform a piece of work in 24 days, how many men can do it in 192 days?

days.		*men.*		*days.*	
192	:	48	: :	24	:

24

192
96

192) 1152(6 *men, Ans.*
1152

3. If £100 in 12 months gain a certain interest, what sum will gain the same in 8 months? *Ans.* £150.

4. If 3 ounces of silver cost 17*s.*, what cost 48 *oz.*?
Ans. £13 .. 12.

QUESTIONS ON THE FOREGOING.

What is Proportion?
What is Geometrical Proportion?
When are four quantities proportional?
How is that proportion denoted?
What is direct proportion?
What is inverse proportion?
What is the foundation of the Rule of Three?
What is the Rule of Three?
How many numbers are given?
What is the first observation respecting the given numbers?
What is the second?
Which number do you set down first and for what?
How do you find out how to set down the others?
When do you put the greater at the right hand, and when the less?
When you have your question stated, which numbers do you multiply together?
By which do you divide?
When your first and third terms consist of different denominations, what is to be done?
What, when your middle term consists of different denominations?
Of what denomination will the quotient be?
If there is any remainder after division, what is to be done?
If the quotient is in a lower denomination, what is to be done?

COMPOUND PROPORTION,

OR THE DOUBLE RULE OF THREE,

Is that which embraces such questions as require two or more statings in the Single Rule of Three.

The number of terms given will always be odd, that is, there will be five, or seven, or nine, &c.

If more than five terms be given, work by several statings in the Single Rule of Three.

If five numbers be given to find a sixth, three of them will be a supposition, and two a demand. Then work by the following

RULE.

1. Write down the three terms of supposition, so that the principal *cause* of gain or loss shall possess the first place; the *means*, that is, the distance, time, &c. the second; and the *effect* produced, that is, the gain, loss, &c. the third; then place the other two numbers under those of the same name.

2. If the blank place falls under the third term, multiply the two first together for a divisor, and the rest for a dividend.

3. But if the blank falls under any other term, multiply the third and fourth terms together for a divisor, and the rest for a dividend. And the quotient will be the answer, or term sought.

Note. If any of the terms consist of different denominations, they must be reduced, as in the single rule of three.

EXAMPLE 1.

If 3 men, in 4 days, eat 6*lb.* of bread, how much will suffice 6 men for 12 days?

Here, to know how to state the question, I consider what are the terms of supposition, and find them to be, that 3 men, in 4 days, eat 6*lb.* of bread. These, then, are to be the three first terms. Next, to know in what order to place them, I consider which is the operating *cause*, and find it to be 3 men. This, then, is the first term. I then consider which is the *means*, or time, and find it to be 4 days; therefore this is the second term. The 6*lb.* of bread is the *effect*, and is therefore the third term. And they stand thus:

men.	*days.*	*lb.*
3	4	6

I then wish to know where to place the other two; and the rule is, under those of the same name. And the whole stands thus:

men.	*days.*	*lb.*
3	4	6
6	12	

Now, to know which terms to multiply for a divisor, and which for a dividend, I consider where the blank falls; and it being under the third term, I multiply the first and second for a divisor, and the rest for a dividend.

Divisor.	*Dividend.*
3	6
4	6
—	—
12	36
	12
	—

12)432(36 *Quotient.*
36
—
72 And the answer is 36*lb.*
72

EXAMPLE 2.

If 7 men can reap 84 acres of wheat in 12 days, how many men can reap 100 acres in 5 days?

Stated thus:

men.	*days.*	*acres.*
7	12	84
	5	100

Here, because the blank falls not under the third term, I multiply the third and fourth terms together for a divisor, and the rest for a dividend.

Divisor.	*Dividend.*
84	7
5	12
—	—
420	84
	100

420)8400(20 *Quotient.*
840 And the answer is 20 *men.*

CONTRACTIONS.

Questions in this rule may be contracted several ways. 1. When the same number is found in both divisor and dividend, strike it out of both. 2. If a number in one will divide a number in the other without a remainder, strike out both, and put the quotient of the one divided in its place. 3. If both divisor and dividend can be divided by the same number without a remainder, their quotients may be substituted.—The reason for which contractions is, that when a number is multiplied by any figure, and the product divided by the same figure, the number remains just as it was at first.

Take the preceding examples.

men.	*days.*	*lb.*	
*3	*4	6	6
6	*12		6
			—
			36 *Ans.*

Here, $3\times4=12$. This being the divisor, and there being 12 also in the dividend, the 3, 4, and 12, marked with an asterisk, may be struck out; and there remains only 6 and 6, parts of the dividend, to be multiplied together, which makes 36; and there being none of the divisor left, 36 is the answer.

In the second example,

men.	*days.*	*acres.*	
*7	*12	*84	5)100
	5	100	—
			20 *Ans.*

84 and 5 form the divisor, and 7, 12 and 100 the dividend. 7×12 is 84, which being struck out of the dividend, and 84 being struck out of the divisor, there remains 100 to be divided by 5, which gives 20 for the answer.

This method of contraction may be used also in the single rule of three, and in division, and in any other operations of a similar nature.

Questions on the foregoing.

What is the Double Rule of Three?
If more than five numbers are given, how must you proceed?
If five are given, what will they be?
How do you state questions in this rule?
How do you proceed after your question is stated?
What if any of the numbers consist of different denominations?
How may questions in this rule be contracted?
On what reason are such contractions founded?
Can such contractions be made in any other rule?

THE SINGLE RULE OF THREE, IN VULGAR FRACTIONS.

Rule.

1. State the question as in the Rule of Three in whole numbers.

2. Prepare the fractions as in multiplication of vulgar fractions.

3. Invert the terms of the divisor, and proceed as in multiplication.

Note. The operation may frequently be contracted, as in Case 5 of Reduction of Vulgar Fractions.

EXAMPLE.

If $\frac{3}{5}$ of a yard cost $\frac{7}{15}$ of a £., what cost $\frac{3}{14}$ of a yard?

Operation. Here, in order to state the question, I consider whether the answer needs to be more or less; and finding it must be less, I say,

yd. £. *yd.*

$\frac{3}{5}$: $\frac{7}{15}$ :: $\frac{3}{14}$: *the Answer.*

Next, I consider whether the fractions need any reduction, to prepare them for the further operations, and find that they do not.

Then, I invert the terms of that which will be the divisor, $\frac{3}{5}$, and it makes $\frac{5}{3}$; and multiply them all together, as follows:

$\frac{5}{3} \times \frac{7}{15} \times \frac{3}{14} = \frac{105}{630}$, that is $\frac{1}{6}$ of a £.

which being reduced, is $\frac{1}{6}$ of a £. or 3*s.* 4*d.*, which is the answer.

CONTRACTION.

This operation may be contracted as follows:

$$\frac{\overset{*}{5}}{\underset{*}{3}} \times \frac{\overset{*}{7}}{\underset{*}{15}} \times \frac{\overset{*}{3}}{\underset{*}{14}} = \frac{1}{6}.$$

3 2

Here, there being a 3 in the line of numerators, and another in the line of denominators, they are both struck out. Next, the denominator 15 is divided by the numerator 5, and the quotient 3 substituted for the 15, and both 15 and 5 are struck out. Then, the denominator 14 is divided by the numerator 7, and the quotient 2 is substituted for the 14, and the 14 and 7 are struck out. Now, all the numerators being struck out, I put down 1 for a numerator; and there being nothing left of the denominators but 3 and 2, I multiply them together, and it makes 6, and the answer is $\frac{1}{6}$, as before.

THE DOUBLE RULE OF THREE IN VULGAR FRACTIONS.

RULE.

1. State the question as in the double rule of three in whole numbers.

2. Prepare the fractions as in multiplication of vulgar fractions.

3. Invert the terms of those which will form the divisor, and proceed as in multiplication.

EXAMPLE.

When 12 persons use $1\frac{1}{8}$*lb.* of tea per month, how much should a family of 8 persons provide for $\frac{1}{2}$ a year?

Operation. Here, I first state the question according to the rule in whole numbers:

persons.	*yr.*	*lb.*
12	$\frac{1}{12}$	$1\frac{1}{8}$
8	$\frac{1}{2}$	

Next, I prepare the fractions as in multiplication, and it becomes:

persons.	*yr.*	*lb.*
$\frac{12}{1}$	$\frac{1}{12}$	$\frac{9}{8}$
$\frac{8}{1}$	$\frac{1}{2}$	

The blank falling under the third term, I conclude the first and second will form the divisor; and these being inverted, all are multiplied together, as follows:

$$\frac{1}{12}\times\frac{12}{1}\times\frac{9}{8}\times\frac{8}{1}\times\frac{1}{2}=\frac{864}{192}.$$

The product, being reduced, is $\frac{9}{2}$, or $4\frac{1}{2}$, which is the answer. This may be contracted as follows:

$$\frac{1}{\overset{*}{12}}\times\frac{\overset{*}{12}}{1}\times\frac{9}{\overset{*}{8}}\times\frac{\overset{*}{8}}{1}\times\frac{1}{2}=\frac{9}{2}=4\frac{1}{2}\ \textit{Ans.}$$

THE SINGLE RULE OF THREE, AND THE DOUBLE RULE OF THREE, IN DECIMALS.

Questions in these rules are stated and performed as in whole numbers, regard being had to the placing of the decimal point, according to the rules for the multiplication and division of decimals.

EXAMPLE 1.

If 3·5*lb.* of tea cost 14*£.* what cost 5·25*lb.*?

Operation.

lb.		*£.*		*lb.*
3·5	:	1·4	: :	5·25 :
				1·4
				2100
				525

3·5)7·350(2·10*£. Ans.*
70

35
35

EXAMPLE 2.

If 4·2 bushels of wheat serve 1·6 men 2·5 months, how many bushels will serve 5 men 3·2 months?

Operation.

men.	*months.*	*bush.*
1·6	2·5	4·2
5	3·2	

dividend.
3·2
4·2
divisor. —
2·5 64
1·6 128
150 13·44
25 5
4·00)67·20(16·8 *Ans.*
400
2720
2400
3200
3200

QUESTIONS ON THE FOREGOING.

How do you state questions in the Single Rule of Three in Vulgar Fractions?
How do you prepare the fractions?
How do you proceed then?
How can the operation be contracted?
How do you perform questions in the Double Rule of Three in Vulgar Fractions?
How do you perform questions in the Single and Double Rule of Three in Decimals?

EXERCISE 48.

If 3*lb.* cost 5*s.* what cost 9*lb.*? *Ans.* 15*s.*

5	4	15	12
7	9	35	45
6	8	24	32
7	8	21	24
5	9	20	36
9	6	45	30
5	8	15	24
6	4	24	16
7	6	21	18
8	10	40	50
9	4	27	12
11	12	55	60
7	3	42	18
4	9	16	36
5	6	35	42

Exercise 49.

												s.	d.
If 6	cost	4	s.	what	cost	9	?				*Ans.*	6	0
8	-	6	-	-	-	6	-	-	-			4	6
3	-	5	-	-	-	2	-	-	-			3	4
3	-	4	-	-	-	5	-	-	-			6	8
3	-	7	-	-	-	8	-	-	-			18	8
3	-	8	-	-	-	2	-	-	-			5	4
3	-	2	-	-	-	5	-	-	-			3	4
3	-	4	-	-	-	7	-	-	-			9	4
3	-	5	-	-	-	5	-	-	-			8	4
4	-	5	-	-	-	5	-	-	-			6	3
4	-	3	-	-	-	7	-	-	-			5	3
2	-	5	-	-	-	5	-	-	-			12	6
2	-	7	-	-	-	3	-	-	-			10	6
4	-	7	-	-	-	5	-	-	-			8	9
4	-	3	-	-	-	9	-	-	-			6	9
2	-	9	-	-	-	3	-	-	-			13	6

PRACTICE,

Is a short method of finding the value of any number of articles, from the price of one being known.

Table of Proportional Parts.

MONEY.

q.	*d.*		
1	is	$\frac{1}{4}$	
2	is	$\frac{1}{2}$	

d.		*s.*
1	is	$\frac{1}{12}$
$1\frac{1}{2}$	is	$\frac{1}{8}$
2	is	$\frac{1}{6}$
3	is	$\frac{1}{4}$
4	is	$\frac{1}{3}$
6	is	$\frac{1}{2}$

s.	*d.*		*£.*
1	0	is	$\frac{1}{20}$
1	8	is	$\frac{1}{12}$
2	0	is	$\frac{1}{10}$
2	6	is	$\frac{1}{8}$
3	4	is	$\frac{1}{6}$
4	0	is	$\frac{1}{5}$
5	0	is	$\frac{1}{4}$
6	8	is	$\frac{1}{3}$
10	0	is	$\frac{1}{2}$

WEIGHT.

lb.		*Cwt.*
7	is	$\frac{1}{16}$
8	is	$\frac{1}{14}$
14	is	$\frac{1}{8}$
16	is	$\frac{1}{7}$
28	is	$\frac{1}{4}$
56	is	$\frac{1}{2}$

Case 1.

When the quantity is of one denomination, and the price of one is also of one denomination.

Rule.

Multiply the quantity by the price, and the product will be the answer, in the same denomination with the price.

Or, consider the quantity as so many of that denomination of money which is next higher than the price, and take such proportional part of it as the price is of one of that denomination.

EXAMPLE 1.

What cost 726*lb.* at 11*d.*?

Operation.

726
11

12)7986 *d.*

20)665 .. 6

£33 .. 5 .. 6 *Ans.*

EXAMPLE 2.

What cost 734*lb.* at 4*d.*?

Operation.

4*d.* is $\frac{1}{3}$*s.* | 734 *s.* = amount at 1*s.*

20 | 244 *s.* 8*d.* = am't at 4*d.*

£12 .. 4 .. 8 *Ans.*

Here, I consider 734 as so many shillings; and since 4*d.* is $\frac{1}{3}$ of a shilling, I take $\frac{1}{3}$ of 734*s.* which is 244*s.* 8*d.* for the answer in shillings, which being reduced to pounds, gives £12 .. 4 .. 8, for the answer.

Note. In dividing 734 by 3, there is 2 remainder; but because the dividend is shillings, it is 2 thirds of a shilling, that is 8*d.*

CASE 2.

When the quantity is of one denomination, and the price is of different denominations.

RULE.

Multiply the quantity by the highest denomination of the price, and add such proportional part of it, as the remainder of the price is of one of that denomination.

Or, reduce the price to the lowest denomination, and work by Case 1.

EXAMPLE 1.

What cost 736*lb.* at 2*s.* 6*d.*?

Operation.

736
2

6*d.* is $\frac{1}{4}$	1472	= amount at 2*s.*
	368	= amount at 6*d.*
20	1840	= am't at 2*s.* 6*d.*

£92 .. 0 *Ans.*

Here, I first multiply 736, the quantity, by 2*s.* the highest denomination of the price, & it makes 1472 *s.*, which is the amount of the whole quantity at 2*s.* Then, because 6*d.* is $\frac{1}{4}$ of 2*s.* I add $\frac{1}{4}$ of 1472*s.* which is 368*s.*, and have 1840*s.* for the amount at 2*s.* 6*d.* This, being reduced to pounds, gives £92, for the answer.

EXAMPLE 2.

What cost 428 tons, at £3 .. 4 .. 6½ per ton?

Operation.

	£.
4*s.* is $\frac{1}{5}$	428 amount at 1 £.
	3
	1284 amount at 3 £.
6*d.* is $\frac{1}{8}$	85 .. 12 amount at 4*s.*
½*d.* is $\frac{1}{12}$	10 .. 14 amount at 6*d.*
	17 .. 10 amount at ½*d.*

£1381 .. 3 .. 10 am't at £3 .. 4 .. 6½, *Ans.*

Here, I first multiply 428, the quantity, by £3, the highest denomination of the price, and it makes £1284, which is the amount of the whole quantity at £3. Then, because 4*s.* is $\frac{1}{5}$ of a pound, I take $\frac{1}{5}$ of £428, which is *L*85 .. 12, for the amount at 4*s.* Then, because 6*d.* is $\frac{1}{8}$ of 4*s.* I take $\frac{1}{8}$ of *L*85 .. 12, which is *L*10 .. 14, for the amount at 6*d.* Lastly, because ½*d.* is $\frac{1}{12}$ of 6*d.* I take $\frac{1}{12}$ of *L*10 .. 14, which is 17*s.* 10*d.* for the amount at ½*d.* All which, added together, gives *L*1381 .. 3 .. 10, for the answer.

CASE 3.

When both the price of one, and the quantity, are of different denominations.

RULE.

Multiply the price by the highest denomination of the quantity, and take proportional parts for the rest.

Or, work by the Rule of Three, which will usually be the better way.

EXAMPLE.

What cost 17 *Cwt.* 3*qr.* 19*lb.* at *L*2 .. 2 .. 6 per *Cwt.*?

Operation.

	£.	s.	d.	
2*qr.* is $\frac{1}{2}$	2 ..	2 ..	6×5	12+5=17
			12	
	25 ..	10 ..	0	amount of 12 *Cwt.*
	10 ..	12 ..	6	amount of 5 *Cwt.*
1*qr.* is $\frac{1}{2}$	1 ..	1 ..	3	amount of 2 *qrs.*
16*lb.* is $\frac{1}{7}$		10 ..	$7\frac{1}{2}$	amount of 1 *qr.*
2*lb.* is $\frac{1}{8}$		6 ..	$0\frac{3}{4}$	amount of 16 *lb.*
1*lb.* is $\frac{1}{2}$			9	amount of 2 *lb.*
			$4\frac{1}{2}$	amount of 1 *lb.*

Ans. £38 .. 1 .. $6\frac{3}{4}$ amount of 17 *Cwt.* 3*qrs.* 19*lb.*

The reason why I multiply by 12 and by 5, is, that 12 and 5 is 17, and multiplying £2 .. 2 .. 6 by 12 and by 5, and adding their products, is the same as multiplying it by 17. In taking the parts, when I say 16*lb.* is $\frac{1}{7}$, it is not $\frac{1}{7}$ of 1*qr.* but $\frac{1}{7}$ of 1 *Cwt.*, and the upper line is to be divided by 7, and not the line opposite to which it stands, as in the rest.

TARE AND TRETT,

Are allowances made to the buyer on some particular commodities.

Tare is the weight of the barrel, box, bag, &c.

Trett is an allowance of 4*lb.* per 104*lb.* for waste and dust.

Gross is the weight of the goods, together with that in which they are contained.

Neat is the weight of the goods, after all allowances are deducted.

CASE 1.

When the tare is so much in the whole gross weight.

RULE.

Subtract the tare from the gross, and the remainder is the neat.

EXAMPLE.

What is the neat weight of 56 *Cwt.* 1*qr.* 19*lb.* of tobacco, the tare being 15 *Cwt.* 2*qr.* 13*lb.*?

Cwt.	*qr.*	*lb.*	
56 ..	1 ..	19	gross.
15 ..	2 ..	13	tare.
40 ..	3 ..	6	neat, *Ans.*

CASE 2.

When the tare is so much per barrel, box, &c.

RULE.

Multiply the number of barrels, boxes, &c. by the tare, and the product will be the whole tare, which subtract from the gross, the remainder is the neat.

EXAMPLE.

What is the neat weight of 16 hhds. of tobacco, the gross being 86 *Cwt.* 2*qr.* 14*lb.* and the tare being 100*lb.* per hhd. ?

Tare.

16
100

28) 1600*lbs.* (57*qrs.* 4*lb.*
140
200
196
4

4)
14 .. 1 .. 4
Cwt. qr. lb.

Cwt.	*qr.*	*lb.*	
86	2	14	gross.
14	1	4	tare.
72	1	10	neat, *Ans.*

CASE 3.

When the tare is so much per *Cwt.*

RULE.

Deduct from the gross such proportional part of it, as the tare is of a *Cwt.* and the remainder will be the neat.

Or, multiply the pounds gross by the tare per *Cwt.* and divide the product by 112, the quotient will be the tare, which deduct as before.

EXAMPLE.

In 12 butts of currants, each 7 *Cwt.* 1*qr.* 10*lb.*, tare per *Cwt.* 16*lb.*, how much neat ?

Cwt. qr. lb.
7 .. 1 .. 10
12

16*lb.* is $\frac{1}{7}$

88	0	8	gross.
12	2	9	tare.
75	1	27	neat, *Ans.*

Or, according to the second method, as follows:

Cwt.	*qr.*	*lb.*
7	1	10
		12
88	0	8
		4
		352
		28
		2824
		704
		9864 *lb.* gross.
		16 *lb.* tare per *Cwt.*
		59184
		9864
		157824

112)157824(1409 *lb.* tare.
112

458
448

1024
1008

16

9864 *lb.* gross.
1409 *lb.* tare.

28)8455 *lb.* neat.
84 (301 *qrs.*

55 4)301
28
75 .. 1

27 *lb.*

Ans. 75 *Cwt.* 1*qr.* 27*lb.*

Case 4.

When trett is allowed with tare.

Rule.

Deduct the tare as before, and the remainder is called *suttle;* which, divided by 26, (which is ¼ of 104,) will give the trett, and that being subtracted from the suttle, the remainder will be the neat.

Example.

In 8 *Cwt.* 3*qr.* 20*lb.* gross, tare 38*lb.* trett 4 *lb.* per 104 *lb.*, how many *lbs.* neat?

Cwt. qr. lb.
8 .. 3 .. 20
4

35 — 962 *lb.* suttle.
28 — 37 *lb.* trett.

300 — 925 *lb.* neat, *Ans.*
70

1000 *lb.* gross.
38 *lb.* tare.

26)962 *lb.* suttle.
78 (37 *lb.* trett.

182
182

Note. Another allowance, called *Cloff*, is sometimes made, of 2*lb.* for every 3 *Cwt.*, which may be found by Case 3.

QUESTIONS ON THE FOREGOING.

What is practice?
What is the first case?
What is the rule?
The second case? the rule?
The third case? the rule?
What is tare?
What is trett?
What is gross weight?
What is neat weight?
What is suttle?
What is the first case? the rule?
The second? the rule? The third? the rule?
The fourth? the rule?
Why do you divide by 26?

INTEREST,

Is an allowance made for the use of money.

The *Principal* is the sum at interest, or the sum for the use of which the allowance is made.

The *Rate per cent.* is the interest of £100, or $100, or the allowance made for the use of it, for one year.

The *Amount* is the sum of the principal and interest.

SIMPLE INTEREST,

Is that which arises from the principal only.

CASE 1.

To find the interest, when the principal, time, and rate per cent, are given.

RULE 1.

Say: As 100 is to the rate per cent,
So is the principal to the interest for one year. Then,

Multiply the principal by the rate per cent, and divide the product by 100. The quotient will be the interest for one year.

Note 1. To divide by 100, point off the two right hand figures, and the other figures will be the quotient.

Note 2 To multiply by a mixed number, as $6\frac{1}{2}$, or $5\frac{3}{4}$, multiply by the whole number, and take proportional parts for the fraction.

EXAMPLE 1.

What is the interest of £87 .. 14 .. 5 for one year, at 6 per cent?

£. s. d.	
87 .. 14 .. 5	Here, I multiply the principal, *L*87 .. 14 .. 5,
6	by the rate per cent, 6, and the product is
———	*L*526 .. 6 .. 6. The pounds being divided by
5·26 .. 6 .. 6	100, give *L*5 interest, and *L*·26 remainder.
20	I set down *L*5 in the answer, and multiply
———	the 26 by 20, to bring it into shillings, adding
5·26	in the 6 shillings, and it makes 526 shillings.
12	This, again, being divided by 100, gives 5*s.*
———	interest, and 26*s.* remainder. I set down 5*s.*
3·18	in the answer, and multiply the 26 by 12, to
4	bring it into pence, adding in the 6 pence, and
———	it makes 318 pence. This again being divi-
·72	ded by 100, gives 3*d.* interest, and 18*d.* re-
*Ans. L*5 .. 5 .. 3	mainder. I set down 3*d.* in the answer, and

multiply the 18 by 4, to bring it into farthings, and it makes 72 farthings, which being less then 100, cannot be divided by it, and makes only $\frac{72}{100}$ of a farthing, and is of no importance in this place. So that the answer is *L*5 .. 5 .. 3.

Second method. Reduce the principal to its lowest denomination; then multiply by the rate per cent, and divide by 100; and then reduce the answer to a higher denomination. Take the same example:

L.	*s.*	*d.*
87 ..	14 ..	5
20		
1754		
12		
21053	principal in pence.	
6	rate per cent.	
1263·18		

The interest, therefore, is 1263*d.*, which being reduced to pounds, is *L*5 .. 5 .. 3, as before.

EXAMPLE 2.

What is the interest of $37·45 for one year, at 5½ per cent?

$37·45
5½
187·25 product by 5.
18·72½ product by ½.
205·97½ product by 5½.

This product being divided by 100, or the decimal point being removed two figures to the left, is 2·597½, or 2 dollars, 5 cents, 9 mills, and 7½ tenths of a mill, which is the answer.

EXAMPLE 3.

What is the interest of *L*20 .. 16 .. 6 for one year, at 6¾ per cent?

L.	*s.*	*d.*	
20	16	6	
		6¾	
124	19	0	product by 6.
10	8	3	product by ½.
5	4	1½	product by ¼.
1·40	11	4½	product by 6¾.
20			
8·11			
12			
1·36			
4			
1·46			

Ans. *L*1 .. 8 .. 1¼.

Having found the interest for one year, find it for any other time, by multiplication, the rule of three, or practice, as the case may require.

RULE 2.

To find the interest for any time at 6 per cent, multiply the principal by half the time in months, and divide by 100.

EXAMPLE 1.

What is the interest of $916·72 for one year and 4 months, at 6 per cent?

Operation.

$916·72 principal.
8 half the number of months.
73·3376

So the answer is 73 dollars, 33 cents, 7 mills, and $\frac{6}{10}$ of a mill.

EXAMPLE 2.

What is the interest of £342 .. 16 .. 6 for one year and 3 months, at 6 per cent?

£.	s.	d.	
342	16	6	
			$7\frac{1}{2}$ half the number of months.
2399	15	6	product by 7.
171	8	3	product by $\frac{1}{2}$.
25·71	3	9	product by $7\frac{1}{2}$.

20

14·23

12

2·85

4

3·40

Ans. £25 .. 14 .. $2\frac{3}{4}$.

RULE 3.

Multiply the principal by the number of days, and that product by the rate per cent, and divide by 36500; the quotient will be the interest.

EXAMPLE.

What is the interest of 752 dolls. for 101 days, at 7 per cent?

Operation. $752\times101=75952$, and $75952\times7=531664$; and $53{,}664\div36500=\$14{\cdot}366+$, which is the interest.

Note 1. The reason for dividing by 36500, is, that there are 365 days in a year, and dividing by 36500 is the same as dividing by 365 and by 100.

Note 2. Instead of dividing by 36500, you may multiply by the decimal ·0000274, which is *(nearly)* the quotient of 1 divided by 36500; and the result will be the same. Or, in Federal money, multiply by 274, and point off the seven right hand figures for decimal parts of a dollar. Take the same question:

$752\times101=75952$, and $75952\times7=531664$, and $531664\times{\cdot}0000274=14{\cdot}5675936$, or $\$14{\cdot}5675936$, which is the interest.

CASE 2.

The method pursued by the banks.

As the interest of 100 dollars at 6 per cent is just 1 dollar, or 100 cents, for two months, the interest of any number of dollars for that time, is the same number of cents. Hence the following

RULE.

Set down the principal in dollars and decimal parts of a dollar, and remove the decimal point two figures to the left, and you have the interest of that sum for two months at 6 per cent. For any greater or less time, work by multiplication, or practice.

Note 1. If you wish to find the interest at 7 per cent, add to the interest at 6 per cent, 1 sixth of itself.

Note 2. The banks reckon 30 days a month, and 360 days a year; so that by this method they gain the interest of 5 days in a year.

EXAMPLE 1.

What is the interest of D7856·43 for 3 months, at 7 per cent?

Operation.

6)78·5643 interest for 2 months at 6 per cent.
13·09405 $\frac{1}{6}$ to be added.

2)91·65835 interest for 2 months at 7 per cent.
45·82917 interest for 1 month at 7 per cent.

$137·48752 interest for 3 months at 7 per cent. *Ans.*

EXAMPLE 2.

What does a bank gain in a year, by pursuing the above method, on 500000 dollars, at 7 per cent?

Operation.

6)5000·00 int. for 60 days at 6 p. c.
833·33$\frac{1}{3}$ $\frac{1}{6}$ to be added.

5 days is $\frac{1}{12}$ of 60 days...12)5833·33$\frac{1}{3}$ int. for 60 days at 7 p. c.

$486·11+ *Ans.*

CASE 3.

To find the sum due on an obligation, when there are several payments.

RULE 1.

1. Find the amount of the principal for the whole time.
2. Find the amount of each payment, computing the interest on it from the time it was made to the time of settlement.
3. Subtract the amount of all the payments from the amount of the whole sum, and the remainder will be the sum due.

EXAMPLE.

A gave a note to B, dated Jan. 1, 1780, for $1000, payable on demand, with interest at 6 per cent, on which are endorsed the following payments:

1. April 1, 1780,	$24.
2. August 1, 1780,	4.
3. December 1, 1780,	6.
4. February 1, 1781,	60.
5. July 1, 1781,	40.

What is due on this note, June 1, 1784?

Operation.

1. The whole time from Jan. 1, 1780, to June 1, 1784, is 4 years and 5 months. The interest of $1000 for that time, is $265; consequently the amount is $1265.

2. The first payment is $24. It was made April 1, 1780. From which to the time of settlement, is 4 years and 2 months. The interest of $24 for that time, is $6, which added to 24, the amount of the first payment is $30.

3. The second payment is $4, made Aug. 1, 1780. Its time is 3 years and 10 months; and its interest 92 cents, which makes its amount $4·92.

4. The third payment is $6, made Dec. 1, 1780. Its time is 3 years and 6 months, and its interest $1·26, which makes its amount $7·26.

5. The fourth payment is $60, made Feb. 1, 1781. Its time is 3 years and 4 months, and its interest $12, which makes its amount $72.

6. The fifth payment is $40, made July 1, 1781. Its time is 2 years and 11 months, and its interest $7, which makes its amount $47.

7. The whole amount of the payments, then, is $161·18; which being subtracted from the amount of the whole sum, $1265, gives the sum due $1103·82, which is the answer.

RULE 2.

The method established by the courts of law in Massachusetts, is the following:

Cast the interest on the whole sum up to the time of the first payment; and if the payment exceeds the interest then due, deduct that excess from the principal, and consider the remainder as the new principal, and cast the interest on that up to the time of another payment, and so on. But if the first payment does not exceed the interest due when it was made, cast the interest on the whole sum from the date of the obligation up to the second payment, and see if the first and

second payments, taken together, exceed the interest due at the time of the second payment. If they do, deduct their excess from the principal, as before; but if they do not, cast the interest again upon the whole sum up to the time of the third payment, or the fourth, or till such time as the payments taken together do exceed the interest then due, and then deduct as before.

Take the preceding example.

Operation.

1. From Jan. 1, 1780, the date of the note, to April 1, 1780, the time of the first payment, is 3 months. The interest of $1000 for 3 months at 6 per cent, is D15. The payment made at that time, D24, exceeds the interest then due by D9, which is therefore to be subtracted from the principal, which being done, leaves D991, to form the new principal.

2. From April 1, 1780, the time of the first payment, to Aug. 1, 1780, the time of the second, is 4 months. The interest of D991 for 4 months is D19·82. The payment then made is D4, which is not so much as the interest then due. So there is nothing to be deducted from the principal at that time.

3. The third payment is made Dec. 1, 1780. But as the second payment did not exceed the interest due at the time it was made, I go back and compute from April 1, 1780, the time of the first payment, to Dec. 1, 1780, which is 8 months. The interest of D991 for 8 months is D39·64. The third payment is D6; and this added to D4, the second payment, is D10, which is less than the interest due at the time of the third payment. So, there is no deduction to be made at that time.

4. The fourth payment is made Feb. 1, 1781. But as the second and third payments did not exceed the interest due at the time when they were made, I must still go back, and compute from the time of the first payment, April 1, 1780. From that time to Feb. 1, 1781, is 10 months. The interest of D991 for 10 months is D49·55. The fourth payment is D60, which, with the two preceding, D4 and D6, is D70. This exceeds the interest now due, by D20·45; which being deducted from D991, the principal, leaves D970·55, for the new principal.

5. The fifth payment is made July 1, 1781, which is 5 months from the time of the fourth. The interest of D970·55 for 5 months, is D24·26; and the payment is D40, which ex-

ceeds the interest then due by D15·74, and that being deducted from D970·55, the principal, leaves D954·81, for the new principal.

6. From the time of the fifth payment to June 1, 1784, the time of settlement, is 2 years and 11 months. The interest of D954·81 for 2 years and 11 months, is D167·09; which being added to the principal, makes the sum due D1121·90, which is the answer.

Note. The method of the first rule is more favorable to the debtor, as appears by the foregoing examples, the difference in the amount being $18 08. But the method of the second rule is more equitable. Because it may so happen, by the method of the first rule, that in a course of years, the obligation may be cancelled, and even the holder of the note brought in debt to the giver, by the payment of the interest only, without any part of the principal being paid; as appears by the following question: Suppose a note was given Jan 1, 1800, for $100, on interest at 6 per cent, and that $6 a year is paid on the first of January in every year, till Jan. 1, 1850; how does the account then stand according to the first rule?

The principal is $100 and the interest on it $6 a year, for 50 years, is D300; so that the amount of the principal is D400. There are 49 payments of 6 dollars each. The interest of the first for 49 years, is D17·64, and its amount is D23·64. The interest of the second for 48 years is D17·28, and its amount is D23 28 and so on. From computing which, it appears, that the amount of the several payments, with the interest on them, is D735. So that at the time of settlement, the holder of the note is indebted to the giver of it D335. Whereas, in equity, nothing has been paid but the interest as it properly became due, and none of the principal has ever been paid.

The second rule is perhaps, as equitable as can conveniently be made, but is not exactly so. Because the interest ought to be paid at the end of every year. If it is paid sooner, there is an advantage to the creditor; if later, to the debtor.

Case 4.

To find the rate per cent, when the amount, time, and principal, are given.

Rule.

As the principal is to the interest for the whole time, so is *L*100 to its interest for the same time. Having found the interest of *L* 00 for any given time, the interest of it for one year may be found by division, multiplication, or practice, as circumstances require.

Example.

At what rate per cent will *L*500 amount to *L*725 in 9 years?

Here, I wish first to find the interest; and knowing the principal and the amount, I subtract the principal, *L*500, from the amount, *L*725, and the remainder, *L*225, is the interest. I then say:

As *L*500 is to *L*225, so is *L*100 to its interest for 9 years. This proportion being worked out, gives *L*45 as the interest

of £100 for 9 years; and this being divided by 9, gives £5 as the interest of £100 for one year, that is, 5 per cent, which is the answer.

CASE 5.

To find the time, when the principal, amount, and rate per cent, are given.

RULE.

Divide the whole interest by that of the principal for one year, and the quotient will be the time.

EXAMPLE.

In what time will £500 amount to £725, at 5 per cent?

Here, I first find the interest of £500 for one year at 5 per cent, which is £25; and then I find, by subtracting, as before, what is the whole interest, which is £225; and then I divide £225 by 25, and it gives 9 years as the answer.

CASE 6.—DISCOUNT.

To find the principal, when the amount, time, and rate per cent, are given.

This case is the same as the rule of *Discount*.

Discount is an abatement made for the payment of money before it becomes due, by accepting as much as, being put out at interest, would amount to the whole debt at the time it becomes due.

The *present worth* is the amount so accepted; and is the same as the principal found by this case.

RULE.

As the amount of £100, at the rate and time given, is to £100, so is the amount or whole debt to the principal or present worth.

To find the discount, subtract the present worth from the whole debt, and the remainder will be the discount.

PROOF.

Find the amount of the present worth at interest for the same rate and time, according to Case 1, and it will equal the whole debt, if the work is right.

EXAMPLE.

What is the discount of £400 for 6 months, at 6 per cent?

Operation.

Here, I first find what £100 will amount to, at interest for 6 months at 6 per cent, which is £ 03. I then say, as £103 is to £100, so is £400 to the present worth; which proportion being worked out, gives £388 .. 6 .. 11¾, for the present worth; which being subtracted from £400, the whole debt, gives £11 .. 13 .. 0¼, as the discount, which is the answer.

INSURANCE, COMMISSION, AND BROKAGE,

Are allowances made to insurers and factors, or other agents, at a stipulated rate per cent; and the amount of such allowance is the same as the simple interest for one year at the same rate per cent, and is found in the same manner.

COMPOUND INTEREST,

Is that which arises from a principal increased from time to time by the addition of the interest to the principal, as often as the interest becomes due.

RULE.

Find the first year's amount by Simple Interest, which will be the principal for the second year; and the amount for the second year will be the principal for the third year, and so on. From the last amount, subtract the first principal, and the remainder will be the compound interest.

EXAMPLE.

What is the compound interest of *L*450 for 3 years, at 5 per cent?

Here, I first find the interest of *L*450 for one year at 5 per cent, which is *L*22 .. 10. I then add this to the principal, and the amount for one year is *L*472 .. 10, which is the principal for the second year. I then find the interest of *L*472 .. 10 for one year, which is *L*23 .. 12 .. 6; and this being added to its principal, the amount for the second year, is 496 .. 2 .. 6, which is the principal for the third year. I then find the interest of *L*496 .. 2 .. 6 for one year, which is *L*24 .. 16 .. 1½; and this being added to its principal, the amount for the third year is *L*520 .. 18 .. 7½. Then subtracting the original principal, *L*450, from this last amount, I have *L*70 .. 18 .. 7½, as the compound interest, and answer.

Note. In this example, the interest is supposed to be payable annually. If it is payable more or less frequently, the interest must be calculated up to the time when it is due, and then added to its principal, to form a new principal.

QUESTIONS ON THE FOREGOING.

What is interest?
What is the principal?
What is the rate per cent?
What is the amount?
What is simple interest?
What is the first case?
What is the first rule?
How do you divide by 100?
How do you multiply by a mixed number?
What is the second method of finding the interest?
Having found the interest for one year, how do you find it for more than a year?
How for less than a year?
What is the second rule?
What is the third rule?
Why do you divide by 36500?
What is the second case? the rule?

What is the third case? the first rule? the second?
Which is the more favorable to the debtor? Which is the more equitable?
What is the fourth case? the rule?
The fifth case? the rule?
The sixth case? What is discount? What is the present worth?
How do you find the present worth? How the discount?
How do you prove the operation?
What are insurance, commission, and brokage?
How are they found?
What is compound interest?
What is the rule?
When you have found the amount for any given time, how do you find the compound interest?
What if the interest is not payable annually?

EXERCISE 50.

Tell the interest, at 6 per cent,			*Ans.*	Tell the interest, at 6 per cent,		*Ans.*
Of $150	for	12 months,	$9·00	Of $250 for	6 months,	7·50
200	8		8·00	125	12	7·50
700	6		21·00	225	6	6·75
800	4		16·00	275	6	8·25
600	1		3·00	300	4	6·00
750	6		22·50	350	6	10·50
100	15		7·50	400	8	16·00
300	9		13·50	475	6	14·25
400	3		6·00	425	12	25·50
500	4		10·00	550	4	11·00

EXERCISE 51.

Tell the interest, at 5 per cent,			*Ans.*	Tell the interest, at 5 per cent,		*Ans.*
Of $120	for	12 months,	D6·00	Of D700 for	6 months,	D17·50
200	3		2·50	140	6	3·50
250	6		6·25	260	9	9·75
340	3		4·25	380	3	4·75
460	6		11·50	900	4	15·00
580	3		7·25	860	6	21·50
600	8		20·00	180	6	4·50
500	3		6·25	240	7	7·00
440	9		16·50	560	3	7·00
620	3		7·75	640	9	24·00

EQUATION,

Is the reduction of several stated times at which money is payable, to one time, which shall be equal in value.

RULE.

Multiply each payment by its time, and divide the sum of all the products by the whole debt, the quotient will be the mean or equated time.

PROOF.

The interest of the sum payable at the equated time, will be equal to the interest of the several payments at their respective times.

EXAMPLE.

A owes B £100, of which £50 is payable in two months, and £50 at four months; what is the equated time?

Operation.

$50\times2=100$
$50\times4=200$

100)300(3 months, *Ans.*

Here, I multiply each payment by the number of months before which it becomes due, and add their products, which makes 300. I then divide this sum by the whole debt, and the quotient is 3 months, for the equated time.

Note This is the common method, but it is not exactly equitable, because the interest is allowed instead of the discount on the payment which is made before it would fall due.

BARTER,

Is exchanging one commodity for another, by duly proportioning their quantities and values.

RULE.

Work by multiplication, the rule of three, or practice, as occasion requires.

EXAMPLE.

How much sugar at 9*d.* per *lb.* must be bartered for 6½ *Cwt.* of tobacco at 14*d.* per *lb.*?

Operation.

Here, I first find the amount of the tobacco at 14*d.*, which is 10192*d.*; and then find how much sugar at 9*d.* that sum will buy, and it is 10 *Cwt.* 12*lb.* and $\frac{4}{9}$ of a *lb.* which is the answer.

LOSS AND GAIN,

Is a method of computing the profit or loss on the purchase and sale of goods.

RULE.

Work by the rule of three, or practice, as occasion requires.

EXAMPLE.

Bought 9 *Cwt.* of cheese at £2 .. 16 per *Cwt.*, and retailed it at 7*d.* per *lb.*; what is gained or lost in the whole?

Operation.

I first find how much was paid for the cheese, which was £25 .. 4; and then how much was received, which was £29 .. 8; and the gain is £4 .. 4.

Note. If the gain or loss per cent is required, it is found by the rule of three, as follows: Make the sum of money employed, the first term; the gain or loss, the second; and 100, the third. Thus, in the preceding example, the sum employed was 25*l.* 4*s*, and the gain was 4*l.* 4*s.*, which is found to be 16*l.* 18*s.* 4*d.* per 100*l.* or 16 and 2 thirds per cent.

FELLOWSHIP,

Is the rule for adjusting the several shares of gain or loss in any joint business.

CASE 1.

When the stocks of the several partners continue for the same time.

RULE.

As the whole sum or stock is to the whole gain or loss, so is each partner's share of stock to his share of the gain or loss.

PROOF.

The sum of the several shares must be equal to the whole gain or loss.

EXAMPLE.

A and B bought a parcel of goods, for which A paid *L*3, and B *L*7. The goods being sold, there was a gain of 25*s*. What is the share of each?

Operation.

I first add the stocks, and find the sum to be *L*10; and then say: As *L*10 is to 25*s*., so is *L*3 to A's share, and *L*7 to B's share; which proportions being worked out, give A 7*s*. 6*d*., and B 17*s*. 6*d*.

CASE 2.

When the stocks continue unequal terms of time.

RULE.

Multiply each man's stock by its time; then, as the sum of the products is to the whole gain or loss, so is each particular product to its share of the gain or loss.

EXAMPLE.

A and B traded as follows: A put in *L*50 for 6 months, and B *L*75 for 3 months, and they gained *L*25. What is the share of each?

Operation.

Here, I first multiply A's stock, *L*50, by its time, 6 months, and A's product is 300. Then I multiply B's stock, *L*75, by its time, 3 months, and B's product is 225. The sum of these products is 525. I then say, as 525 is to *L*25, so is 300 to A's share, and 225 to B's share; which proportions being worked out, give A *L*14 .. 5 .. 8½, and about half a farthing; and B, *L*10 .. 14 .. 3¾, and about half a farthing; which is the answer.

EXCHANGE,

Is the rule by which the money of one state or country is brought into that of another.

Par is equality of value. But the course of exchange is frequently above or below par.

CASE 1.

To reduce the pounds, shillings, pence and farthings of the various currencies, to Federal money.

RULE.

1. Reduce the given sum to pounds & decimals of a pound.

2. Multiply the given sum by the number of pence in a pound, (240,) and divide the product by the number of pence a dollar is worth in the given currency. The quotient will be dollars and decimals of a dollar.

EXAMPLE.

In *L*250 .. 15 .. 6 New-York currency, how many dollars?

Operation. *L*250·775×240=60186·000; and 60186·÷96, (because a dollar is 96*d.* N. York,) is D626·9375, which is the answer.

Note 1. To reduce dollars and decimals of a dollar, to pounds and decimals of a pound, reverse the operation; that is, multiply by the number of pence a dollar is worth, and divide by 240.

Note 2. To shorten the operation, divide the number of pence a dollar is worth, and the number of pence in a pound, by any number that will divide both without a remainder, and make use of the quotients so found for a multiplier and divisor.

According to the above rule, the following table is constructed:

To reduce *L.* currency to dollars.

	multiply by	*and divide by*
New-York, &c.	5	2
New-England, &c.	10	3
Pennsylvania, &c.	8	3
S. Carolina, &c.	30	7
British America,	4	1
Sterling,	40	9
Irish,	160	39

To reduce dollars to *L.* currency.

	multiply by	*and divide by*
New-York, &c.	2	5
New-England, &c.	3	10
Pennsylvania, &c.	3	8
S. Carolina, &c.	7	30
British America,	1	4
Sterling,	9	40
Irish,	39	160

To reduce Sterling to Dollars by a shorter method.

RULE.

Divide the pounds and decimals of a pound by 3, and that quotient by 3; add the two quotients together, and remove the decimal point one figure to the right

EXAMPLE.

In *L*1000 sterling, how many dollars?

Operation.

3)1000

3)333·3333+

111·1111+

D4444·444+ *Ans.*

This is only an abridgment of the other method; for, $\frac{1}{3}$ is $\frac{3}{9}$, and $\frac{1}{3}$ of $\frac{1}{3}$ is $\frac{1}{9}$, and $\frac{3}{9}$ and $\frac{1}{9}$ is $\frac{4}{9}$; and removing the decimal point one figure to the right, is the same as multiplying by 10; and mul-

tiplying by 10 and by 4, is the same as multiplying by 40; therefore, the two parts of the operation are equivalent to taking $\frac{40}{9}$, or multiplying by 40 and dividing by 9, according to the above table; which is equivalent to multiplying by 240, the pence in a pound, and dividing by 54, the pence a dollar is worth in sterling.

CASE 2.

To reduce the Currency of one State to that of another.

RULE 1.

As the number of pence in a dollar in one state, is to the number of pence in a dollar in the other; so is the number of pounds, &c. in the one, to the number of pounds, &c. in the other. Therefore,

Multiply the given sum by the number of pence in a dollar in the currency required, and divide by the number of pence in a dollar in the given currency.

Note. The operation may be shortened, by first dividing the multiplier and divisor by a common divisor, as before stated.

EXAMPLE.

In £100 N. York currency, how much S. Carolina?

Operation. 96 : 56 : : 100 : *Ans.* Therefore, $100 \times 56 = 5600$, and $5600 \div 96 = L58{\cdot}33\frac{1}{3}$, which is the answer.

Or, 96 and 56 may first be divided by the common divisor 8, and their quotients, 12 and 7, used in their room; $100 \times 7 = 700$, and $700 \div 12 = L58{\cdot}33\frac{1}{3}$, as before.

RULE 2.

1. Consider whether you are to add to, or subtract from the given currency, in order to find the amount in the currency required. When the dollar is fewer shillings in the given currency than in the required, you are to add; when it is more, you are to subtract.

2. To find how much you are to add or subtract, find the difference between the value of a dollar in the two currencies, and see what part that is of a dollar in the given currency.

3. Take such part of the given sum, and add it to, or subtract it from itself, as occasion requires.

EXAMPLE 1.

In *L*100 N. England currency, how much Pennsylvania?

Operation.

1. The value of a dollar in New-England currency is fewer shillings than in Pennsylvania; I am therefore to add to the given sum.

2. The value of a dollar in New-England currency is 6*s.*, and in Pennsylvania 7*s.* 6*d.* The difference is 1*s.* 6*d.*, which is $\frac{1}{4}$ of 6*s.* I am therefore to add $\frac{1}{4}$ of the given sum to itself.

3. I find what is $\frac{1}{4}$ of *L*100, the given sum, and it is *L*25; and this added to the given sum, makes *L*125, which is the answer.

EXAMPLE 2.

In *L*100 New-York currency, how much New-England?

Operation.

1. The value of a dollar in New-York currency is more shillings than in New-England; I am therefore to subtract.

2. The value of a dollar in New-York currency is 8*s.*, and in New-England 6*s.* The difference is 2*s.*, which is $\frac{1}{4}$ of 8*s.* I am therefore to subtract $\frac{1}{4}$ of the given sum from itself.

3. I find what is $\frac{1}{4}$ of *L*100, the given sum, and it is *L*25, and this subtracted from the given sum, gives *L*75, for the answer.

By the two preceding rules, the following table is constructed. The parts to be added or subtracted, are found by the second rule, and the multipliers and divisors by the first. It is best to add or subtract, when the numerator of the fraction to be added or subtracted is 1. When that is not the case, it is best to make use of the multipliers and divisors.

Tabular Rules for reducing various Currencies to others.

Look for the given currency in the left hand column, and then look along the top for the currency required, under which, and opposite to the given currency, is the part of the given sum which is to be added or subtracted. Where it is more convenient to multiply and divide, the multipliers and divisors are put down, marked with their proper signs.

	N. York, &c.	N. Eng. &c.	Penn. &c.	S. Car. &c.	Br. America.	Sterling.	Irish.
New-York & N. Carolina.	dollar 8s.	sub. $\frac{1}{4}$.	sub. $\frac{1}{16}$,	sub. $\frac{5}{12}$, or $\times 7$ & $\div 12$	sub. $\frac{3}{8}$, or $\times 5$ & $\div 8$	sub. $\frac{7}{16}$, or $\times 9$ & $\div 16$	sub. $\frac{25}{64}$, or $\times 39$ & $\div 64$
N. England, Virg. Ten. & Kentucky.	add $\frac{1}{3}$.	dollar 6s.	add $\frac{1}{4}$.	sub. $\frac{2}{9}$, or $\times 7$ & $\div 9$	sub. $\frac{1}{6}$.	sub. $\frac{1}{4}$.	sub. $\frac{3}{16}$, or $\times 13$ & $\div 16$
Penn. Del. N. Jer. Mary. & Ohio.	add $\frac{1}{15}$.	sub. $\frac{1}{5}$.	dollar 7s. 6d.	sub. $\frac{17}{45}$, or $\times 28$ & $\div 45$	sub. $\frac{1}{3}$.	sub. $\frac{2}{5}$, or $\times 3$ & $\div 5$	sub. $\frac{7}{20}$, or $\times 13$ & $\div 20$
S. Carolina & Georgia.	add $\frac{5}{7}$, or $\times 12$ & $\div 7$	add $\frac{2}{7}$, or $\times 9$, & $\div 7$	add $\frac{17}{28}$, or $\times 45$ & $\div 28$	dollar 4s. 8d.	add $\frac{1}{14}$.	sub. $\frac{1}{28}$.	add $\frac{5}{112}$, or $\times 117$ & $\div 112$
British America.	add $\frac{3}{5}$, or $\times 8$ & $\div 5$	add $\frac{1}{5}$.	add $\frac{1}{2}$.	sub. $\frac{1}{15}$.	dollar 5s.	sub. $\frac{1}{10}$.	sub. $\frac{1}{40}$.
Sterling.	add $\frac{7}{9}$, or $\times 16$ & $\div 9$	add $\frac{1}{3}$.	add $\frac{2}{3}$, or $\times 5$ & $\div 3$	add $\frac{1}{27}$.	add $\frac{1}{9}$.	dollar 4s. 6d.	add $\frac{1}{12}$.
Irish.	add $\frac{25}{39}$, or $\times 64$ & $\div 39$	add $\frac{3}{13}$, or $\times 16$ & $\div 13$	add $\frac{7}{13}$, or $\times 20$ & $\div 13$	sub. $\frac{5}{117}$, or $\times 112$ & $\div 117$	add $\frac{1}{39}$.	sub. $\frac{1}{13}$.	dollar 4s. $10\frac{1}{2}d$.

CASE 3.

To reduce the weights, measures, and coins of one country, to those of another.

RULE.

The proportion of the weight, measure, or value, of one country, to some known weight, measure, or value, of the other, is usually stated in the question, or is found in the tables of Reduction; and then the answer can be found by the rule of three.

EXAMPLE 1.

The great bell of Moscow weighs 12500·6 Russian poods; how many tons is that, 2 poods being equal to 71*lb.* avoirdupois?

Operation.

poods. *lb.* *poods.*
2 : 71 : 12500·6 : the answer; which proportion being worked out, gives 443771·3*lb.*, or 198 *T.* 2 *Cwt.* 27·3*lb.* for the answer.

EXAMPLE 2.

Abraham gave 400 shekels of silver for the cave and field of Machpelah; how much is that in federal money?

Operation.

By the tables, I find that the shekel of silver is 4 drachmæ, and that one drachma is $12\frac{97}{144}$ cents. 400 shekels is 1600 drachmæ; therefore,

1*dr.* : $12\frac{97}{144}$*cts.* :: 1600*dr.* : the answer; which proportion being worked out, gives D202·77$\frac{7}{9}$, for the answer.

EXAMPLE 3.

The head of Goliah's spear weighed 600 shekels of iron; how many pounds is that, avoirdupois weight?

Operation.

By the tables, I find the shekel to be 4 drachmæ, and the drachma to be 2*dwt.* 6$\frac{3}{4}$*grs.* Troy; and also that 7000*grs.* Troy are equal to 1*lb.* avoirdupois. 600 shekels is 2400 drachmæ; therefore,

1*dr.* : 54$\frac{3}{4}$*gr.* :: 2400*dr.* : the weight in Troy *grs.* which proportion being worked out, gives 13 400*grs.* Troy, for the weight. Then,

7000*grs.* : 1*lb.* :: 131400*grs.* : the answer; which proportion being worked out, gives 18*lb.* 12*oz.* $\frac{17}{35}$*dr.* for the answer.

EXAMPLE 4.

What was the value per bushel, in federal money, of the fine flour mentioned in 2 Kings 7. 18, being 1 seah for a shekel of silver?

Operation.

By the tables, I find the seah to be $\frac{1}{3}$ of the epha, and the epha 60 pints, wine measure, and 15 solid inches. The seah, therefore, is 20 wine pints and 5 solid inches, that is, $582\frac{1}{2}$ solid inches. A shekel of silver is 4 drachmæ, of $12\frac{97}{144}$ *cts.* each, that is $50\frac{2}{3}\frac{5}{6}$ cents; and a bushel is $2150\frac{2}{5}$ solid inches. Therefore,

$582\frac{1}{2}$ *in.* : $50\frac{2}{3}\frac{5}{6}$ *cts.* : : $2150\frac{2}{5}$ *in.* : the answer; which proportion being worked out, gives D1·87$\frac{1}{6}\frac{0}{9}\frac{3}{9}$, for the answer.

Note 1. Sometimes the rate of exchange is stated at a certain sum per cent. That is, £100 in one country are worth so much more than £100 in the other. When this is the case, consider in which currency £100 is worth the most. If in the currency required, add the given rate per cent to £100, and make it the first term of a proportion; make £100 the second term, and the sum in the given currency the third; and proceed as in the rule of three.

Note 2. When the exchange is in favor of the given currency, make £100 the first term; £100 added to the rate per cent, the second; and the given currency the third.

EXAMPLE.

Philadelphia is indebted to London, £1400, Pennsylvania currency; how much is that in sterling money, when the exchange is at 64 per cent in favor of London?

Operation.

Here, I consider, that since the exchange is 64 per cent in favor of London, £100 sterling is equal to £164 Pennsylvania; and so I say, as £164 is to £100, so is £1400 to the answer; which proportion being worked out, gives £853 .. 13 .. 2, and a little more, for the answer.

QUESTIONS ON THE FOREGOING.

What is equation?
How do you find the equated time?
How do you prove equation?
Is this method of equation exactly equitable?
Why so?
What is barter?
By what rule do you work questions in barter?
What is loss and gain?
How do you work questions in loss and gain?
What is fellowship?
What is the first case, and rule?
The second, and rule?
What is the method of proof?
What is exchange?
What is par?
How do you reduce pounds to dollars?
How do you reduce dollars to pounds?
What is the shorter method of reducing pounds sterling to dollars?
What is the reason of this rule?
How do you reduce the currency of one state to that of another, by the first method?
How, by the second method
How do you reduce the weights, measures, and coins of one country, to those of another?
When the rate of exchange is a certain sum per cent. and in favor of the required currency, how do you proceed?
How, when it is in favor of the given currency?

DUODECIMALS,

Are fractions so called because they decrease by twelves, inches being twelfths of a foot, which is the whole number; and seconds being twelfths of an inch, thirds twelfths of a second, and so on. They are chiefly useful to ascertain the superficial or solid content of such things as are measured by feet, inches, &c.

Addition and Subtraction of Duodecimals are performed as in Compound Addition and Subtraction.

MULTIPLICATION OF DUODECIMALS.

RULE.

1. Place the multiplier under the multiplicand, in such manner that the feet of the multiplier stand under the lowest denomination of the multiplicand.

2. Begin with the lowest term of the multiplier, and proceed to the left, placing the product of the lowest term of the multiplicand under its multiplier, and so on through all the terms, carrying 1 for every 12.

3. Take the second term of the multiplier, and proceed in the same manner; and so on through all the terms; and the sum of the products will be the answer.

EXAMPLE 1.

Multiply 8*ft.* 6*in.* 9 *sec.* by 7*ft.* 3*in.* 8 *sec.*

Operation.

Ft.	*in.*	*sec.*	*th.*	*f.*
8 ..	6 ..	9		
	7 ..	3 ..	8	
	5 ..	8 ..	6 ..	0
2 ..	1 ..	8 ..	3	
59 ..	11 ..	3		
62 ..	6 ..	7 ..	9 ..	0 *Ans.*

Here, I first place the multiplier so that 7, the feet, may stand under 9, the seconds of the multiplicand, and the other denominations of the multiplier in order towards the right. I then begin with 8 and 9, the lowest denominations of the multiplier and multiplicand; and say, 8×9 is 72, which being 6 times 12, I set down 0 under the multiplier 8, and carry 6 to the next. Then, I say, 8×6 is 48, and 6 I carried is 54, which being 4 times 12 and 6 over, I set down 6 and carry 4. Then, 8×8 is 64, and 4 I carried is 68, which is 5 times 12, and 8 over. Set down 8, and carry 5. But as there is no other term to multiply, I set down the 5 in the next place.

I then take 3, the next term of the multiplier, and say, 3×9 is 27, which is 2 times 12, and 3 over. Set down 3 un-

der the multiplier 3, and carry 2 to the next. In like manner, I proceed till I have multiplied all the terms of the multiplicand by 3.

I then take 7, the last term of the multiplier, and say 7×9 is 63, which is 5 times 12, and 3 over. Set down 3 under the multiplier 7, and carry 5 to the next. And so on, till I have multiplied all the terms of the multiplicand by 7. I then add up these several products, and the answer is 62*ft.* 6*in.* 7 *sec.* 9 *thirds.*

EXAMPLE 2.

How many feet of wood are there in a load that is 8*ft.* 6*in.* long, 2*ft.* 3*in.* wide, and 3*ft.* 9*in.* high?

Operation.

ft.	*in.*	*sec.*	*th.*	
8	.. 6			length.
	2 .. 3			width.
2	.. 1	.. 6		
17	.. 0			
19	.. 1	.. 6		
		3 .. 9		height.
14	.. 4	.. 1	.. 6	
57	.. 4	.. 6		
71	.. 8	.. 7	.. 6	*Ans.*

QUESTIONS ON THE FOREGOING.

What are Duodecimals?
For what are they useful?
How are addition and subtraction of duodecimals performed?
In multiplication of duodecimals, how do you set down the multiplier?
Where do you begin to multiply?
For how many do you carry 1?
Where do you set down the product of each figure of the multiplicand?
What will be the answer?

EXERCISE 52.

Tell what is the least common multiple of	*Ans.*	Tell what is the least common multiple of	*Ans.*
3, 4, and 5,	60	3, 7, and 6,	42
6, 7, and 8,	168	7, 8, and 3,	168
7, 8, and 9,	504	5, 7, and 8,	280
5, 6, and 7,	210	4, 5, and 7,	140
3, 5, 8, and 10,	120	5, 3, and 9,	45
2, 7, and 14,	28	4, 6, and 7,	84
6, 10, and 8,	120	6, 7, and 12,	84
6, 3, and 11,	66	3, 5, and 8,	120

Exercise 53.

Reduce to a common denominator,	*Ans.*	Reduce to a common denominator,	*Ans.*
$\frac{1}{2}$ and $\frac{2}{3}$,	$\frac{3}{6}$ and $\frac{4}{6}$	$\frac{3}{5}$ and $\frac{2}{3}$,	$\frac{9}{15}$ and $\frac{10}{15}$
$\frac{1}{4}$ and $\frac{1}{2}$,	$\frac{2}{8}$ and $\frac{4}{8}$	$\frac{4}{5}$ and $\frac{5}{6}$,	$\frac{24}{30}$ and $\frac{25}{30}$
$\frac{1}{2}$ and $\frac{1}{3}$,	$\frac{3}{6}$ and $\frac{2}{6}$	$\frac{3}{7}$ and $\frac{1}{2}$,	$\frac{6}{14}$ and $\frac{7}{14}$
$\frac{1}{3}$ and $\frac{1}{5}$,	$\frac{5}{15}$ and $\frac{3}{15}$	$\frac{4}{9}$ and $\frac{1}{4}$,	$\frac{16}{36}$ and $\frac{9}{36}$
$\frac{2}{5}$ and $\frac{3}{4}$,	$\frac{8}{20}$ and $\frac{15}{20}$	$\frac{5}{8}$ and $\frac{1}{7}$,	$\frac{35}{56}$ and $\frac{8}{56}$

Exercise 54.

Tell the sum of	*Ans.*	Tell the sum of	*Ans.*
$\frac{1}{2}$ and $\frac{1}{4}$,	$\frac{3}{4}$	$\frac{3}{5}$ and $\frac{2}{3}$,	$1\frac{4}{15}$
$\frac{1}{2}$ and $\frac{1}{3}$,	$\frac{5}{6}$	$\frac{4}{5}$ and $\frac{5}{6}$,	$1\frac{9}{30}$
$\frac{1}{2}$ and $\frac{2}{3}$,	$1\frac{1}{6}$	$\frac{3}{7}$ and $\frac{1}{2}$,	$\frac{13}{14}$
$\frac{1}{3}$ and $\frac{1}{5}$,	$\frac{8}{15}$	$\frac{4}{9}$ and $\frac{1}{4}$,	$\frac{25}{36}$
$\frac{2}{5}$ and $\frac{3}{4}$,	$1\frac{3}{20}$	$\frac{5}{8}$ and $\frac{1}{7}$,	$\frac{43}{56}$

Exercise 55.

From	take	*Ans.*	From	take	*Ans.*
$\frac{3}{4}$,	$\frac{1}{4}$,	$\frac{1}{2}$	$\frac{3}{4}$,	$\frac{2}{7}$,	$\frac{13}{28}$
$\frac{5}{6}$,	$\frac{1}{3}$,	$\frac{1}{2}$	$\frac{2}{3}$,	$\frac{3}{5}$,	$\frac{1}{15}$
$\frac{1}{2}$,	$\frac{1}{4}$,	$\frac{1}{4}$	$\frac{5}{6}$,	$\frac{4}{5}$,	$\frac{1}{30}$
$\frac{1}{3}$,	$\frac{1}{5}$,	$\frac{2}{15}$	$\frac{3}{4}$,	$\frac{2}{5}$,	$\frac{7}{20}$
$\frac{1}{2}$,	$\frac{1}{9}$,	$\frac{7}{18}$	$\frac{1}{2}$,	$\frac{3}{7}$,	$\frac{1}{14}$

Exercise 56.

Multiply	by	*Ans.*	Multiply	by	*Ans.*
$\frac{1}{2}$,	$\frac{1}{4}$,	$\frac{1}{8}$	$\frac{1}{3}$,	$\frac{2}{3}$,	$\frac{2}{9}$
$\frac{1}{3}$,	$\frac{1}{2}$,	$\frac{1}{6}$	$\frac{1}{4}$,	$\frac{2}{5}$,	$\frac{1}{10}$
$\frac{2}{3}$,	$\frac{1}{8}$,	$\frac{1}{12}$	$\frac{1}{2}$,	$\frac{4}{5}$,	$\frac{2}{5}$
$\frac{1}{5}$,	$\frac{2}{3}$,	$\frac{2}{15}$	$\frac{1}{2}$,	$\frac{5}{6}$,	$\frac{5}{12}$
$\frac{4}{5}$,	$\frac{2}{4}$,	$\frac{2}{5}$	$\frac{1}{3}$,	$\frac{2}{7}$,	$\frac{2}{21}$

Exercise 57.

multiply	by	*Ans.*	multiply	by	*Ans.*
1,	$\frac{3}{8}$,	$\frac{3}{8}$	$1\frac{1}{2}$,	$\frac{1}{2}$,	$\frac{3}{4}$
2,	$\frac{5}{6}$,	$1\frac{2}{3}$	$2\frac{1}{3}$,	$\frac{1}{3}$,	$\frac{7}{9}$
3,	$\frac{4}{5}$,	$2\frac{2}{5}$	$3\frac{1}{4}$,	$\frac{1}{4}$,	$\frac{13}{16}$
4,	$\frac{2}{3}$,	$2\frac{2}{3}$	$4\frac{2}{3}$,	$\frac{1}{2}$,	$2\frac{1}{3}$
5,	$\frac{1}{2}$,	$2\frac{1}{2}$	$5\frac{3}{4}$,	$\frac{3}{4}$,	$4\frac{5}{16}$

Exercise 58.

Divide	by	*Ans.*	Divide	by	*Ans.*
$\frac{1}{2}$,	$\frac{1}{4}$,	2	$\frac{1}{3}$,	$\frac{1}{4}$,	$1\frac{1}{3}$
$\frac{1}{8}$,	$\frac{1}{2}$,	$\frac{2}{8}$	$\frac{1}{4}$,	$\frac{1}{2}$,	$\frac{1}{2}$
$\frac{1}{4}$,	$\frac{1}{3}$,	$\frac{3}{4}$	$\frac{1}{5}$,	$\frac{1}{3}$,	$\frac{2}{5}$
$\frac{1}{5}$,	$\frac{1}{2}$,	$\frac{2}{5}$	$\frac{1}{2}$,	$\frac{1}{2}$,	1
$\frac{1}{2}$,	$\frac{1}{3}$,	$1\frac{1}{2}$	$\frac{1}{3}$,	$\frac{1}{5}$,	$1\frac{2}{3}$

EXERCISE 59.

Tell the sum of						*Ans.*		
£.	s.	d.	£.	s.	d.	£.	s.	d.
2 ..	3 ..	6 and	1 ..	4 ..	3,	3 ..	7 ..	9
3 ..	15 ..	8 and	2 ..	3 ..	5,	5 ..	19 ..	1
2 ..	10 ..	1 and	3 ..	15 ..	11,	6 ..	6 ..	0
2 ..	13 ..	6 and	1 ..	16 ..	8,	4 ..	10 ..	2
10 ..	10 ..	10 and	2 ..	2 ..	2,	12 ..	13 ..	0
5 ..	5 ..	5 and	6 ..	6 ..	6,	11 ..	11 ..	11
13 ..	13 ..	8 and	14 ..	14 ..	4,	28 ..	8 ..	0
5 ..	6 ..	7 and	8 ..	9 ..	10,	13 ..	16 ..	5
4 ..	5 ..	6 and	5 ..	6 ..	7,	9 ..	12 ..	1
3 ..	5 ..	4 and	4 ..	3 ..	5,	7 ..	8 ..	9
6 ..	4 ..	3 and	3 ..	4 ..	6,	9 ..	8 ..	9
3 ..	7 ..	6 and	4 ..	3 ..	6,	7 ..	11 ..	0

EXERCISE 60.

Tell the sum of						*Ans.*		
s.	d.	s.	d.		s. d.	£.	s.	d.
3 ..	6 and	4 ..	6 and	5 ..	6,		13 ..	6
2 ..	4 and	3 ..	4 and	4 ..	4,		10 ..	0
3 ..	5 and	4 ..	6 and	5 ..	7,		13 ..	6
7 ..	6 and	8 ..	8 and	9 ..	9,	1 ..	5 ..	11
3 ..	4 and	5 ..	6 and	7 ..	8,		16 ..	6
8 ..	7 and	6 ..	5 and	4 ..	3,		19 ..	3
6 ..	5 and	6 ..	6 and	6 ..	7,		19 ..	6
4 ..	8 and	5 ..	6 and	6 ..	4,		16 ..	6
3 ..	5 and	3 ..	9 and	3 ..	11,		11 ..	1
11 ..	3 and	9 ..	3 and	5 ..	3,	1 ..	5 ..	9
6 ..	8 and	7 ..	6 and	8 ..	4,	1 ..	2 ..	6
2 ..	7 and	6 ..	3 and	4 ..	5,		13 ..	3

EXERCISE 61.

From			take			*Ans.*		
£.	s.	d.	£.	s.	d.	£.	s.	d.
1 ..	1 ..	0,		13 ..	6,		7 ..	6
2 ..	3 ..	6,		19 ..	0,	1 ..	4 ..	6
	18 ..	5,		13 ..	6,		4 ..	11
2 ..	2 ..	2,	1 ..	3 ..	5,		18 ..	9
1 ..	17 ..	8,		18 ..	9,		18 ..	11
3 ..	18 ..	0,	1 ..	19 ..	6,	1 ..	18 ..	6
1 ..	12 ..	10,		18 ..	6,		14 ..	4
1 ..	1 ..	1,		19 ..	9,		1 ..	4
2 ..	2 ..	2,	1 ..	11 ..	11,		10 ..	3
3 ..	3 ..	3,	2 ..	19 ..	0,		4 ..	3
4 ..	5 ..	6,	3 ..	4 ..	5,	1 ..	1 ..	1
5 ..	4 ..	3,	3 ..	4 ..	5,	1 ..	19 ..	10

EXERCISE 62.

Tell what is	*Ans.*	Tell what is	*Ans.*
s. d.	£. s. d.	s. d.	£. s. d.
3 times 6 .. 8,	1 .. 0 .. 0	3 times 9 .. 9,	1 .. 9 .. 3
4 times 2 .. 3,	9 .. 0	5 times 8 .. 8,	2 .. 3 .. 4
5 times 10 .. 6,	2 .. 12 .. 6	6 times 2 .. 3,	13 .. 6
6 times 5 .. 6,	1 .. 13 .. 0	5 times 4 .. 8,	1 .. 3 .. 4
7 times 4 .. 6,	1 .. 11 .. 6	9 times 5 .. 5,	2 .. 8 .. 9
8 times 8 .. 8,	3 .. 9 .. 4	3 times 10 .. 10,	1 .. 12 .. 6
7 times 7 .. 7,	2 .. 13 .. 1	8 times 6 .. 7,	2 .. 12 .. 8
4 times 6 .. 6,	1 .. 6 .. 0	7 times 9 .. 10,	3 .. 8 .. 10

EXERCISE 63.

Tell what is the	*Ans.*	Tell what is the	*Ans.*
£. s. d.	s. d.	£. s. d.	s. d.
4th of 1 .. 8 .. 0,	7 .. 0	10th of 9 .. 2,	0 .. 11
3d of 1 .. 4 .. 6,	8 .. 2	6th of 1 .. 5 .. 6,	4 .. 3
5th of 3 .. 0 .. 0,	12 .. 0	4th of 1 .. 12 .. 8,	8 .. 2
6th of 1 .. 4 .. 6,	4 .. 1	5th of 1 .. 15 .. 10,	7 .. 2
7th of 2 .. 2 .. 0,	6 .. 0	7th of 2 .. 2 .. 7,	6 .. 1
3d of 1 .. 1 .. 3,	7 .. 1	8th of 1 .. 14 .. 8,	4 .. 4
8th of 2 .. 8 .. 0,	6 .. 0	3d of 13 .. 9,	4 .. 7
9th of 1 .. 7 .. 9,	3 .. 1	4th of 17 .. 8,	4 .. 5

EXERCISE 64.

Tell how many times	*Ans.*	Tell how many times	*Ans.*
s. d. s. d.		s. d. s. d.	
1 .. 2 in 4 .. 8,	4	3 .. 5 in 10 .. 3,	3
2 .. 6 in 12 .. 6,	5	1 .. 3 in 6 .. 3,	5
1 .. 1 in 6 .. 6,	6	2 .. 5 in 9 .. 8,	4
2 .. 1 in 6 .. 3,	3	1 .. 5 in 8 .. 6,	6
1 .. 5 in 5 .. 8,	4	1 .. 7 in 7 .. 11,	5
1 .. 2 in 7 .. 0,	6	2 .. 9 in 8 .. 3,	3
2 .. 2 in 6 .. 6,	3	1 .. 11 in 7 .. 8,	4
3 .. 1 in 12 .. 4,	4	2 .. 3 in 11 .. 3,	5

INVOLUTION,

Is the raising of numbers to powers.

A *power*, is a number produced by multiplying a smaller number by itself a certain number of times.

The smaller number so multiplied to produce a power, is called the *root* of that power.

Thus, $3\times3=9$. Here, 9 is the power, and 3 is its root.

$4\times4\times4=64$. Here, 64 is the power, and 4 is its root.

$5\times5\times5\times5=625$. Here, 625 is the power, and 5 is its root.

When a number is multiplied by itself once, the product is called the second power, or *square*, of that number; and the number multiplied is called the *square root* of that product. As, $3\times3=9$; here, 9 is the second power or square of 3; and 3 is the square root of 9. Again, $5\times5=25$; here, 25 is the square of 5, and 5 is the square root of 25.

When a number is multiplied by itself, and the product so produced is multiplied again by the same number, the second product is called the third power, or *cube* of that number; and the number is called the *cube root* of that second product. As, $4\times4\times4=64$; here, 64 is the third power of 4, and 4 is the cube root of 64. Again, $3\times3\times3=27$; here, 27 is the cube of 3, and 3 is the cube root of 27.

When a number is multiplied by itself, and that product again by the same number, and the second product again by the same number, the third product is called the fourth power, or *biquadrate* of that number; and the number is called the fourth root, or *biquadrate root* of that third product. As, $2\times2\times2\times2=16$; here, 16 is the fourth power of 2, and 2 is the fourth root of 16. Again, $3\times3\times3\times3=81$; here, 81 is the fourth power of 3, and 3 is the fourth root of 81.

RULE.

To raise a given number to any given power, multiply that number by itself, and that product by the given number, and so on, till the number of multiplications shall be one less than the number of the given power.

EXAMPLE.

Find the sixth power of 2.

Operation.

2
2
—
4 square.
2
—
8 cube.
2
—
16 biquadrate.
2
—
32 5th power.
2
—
64 6th power. *Ans.*

A vulgar fraction is involved to any power required, by involving the numerator to that power, and then involving the denominator to the same power. Thus the square of $\frac{2}{3}$ is $\frac{4}{9}$, and the cube of $\frac{3}{2}$ is $\frac{27}{8}$.

EVOLUTION,

Is extracting or finding the roots of given powers.

Numbers, with respect to their roots, are rational, or irrational.

A rational number is one of which the exact root can be found.

An irrational number, or *surd*, is a number of which the exact root cannot be found.

The same number may be rational with respect to one of its roots, and irrational with respect to another. Thus, 4, with respect to its square root, is rational; but with respect to its cube root, it is irrational; for the square root of 4 can be found, but the cube root of 4 cannot be found exactly.

TABLE OF POWERS AND ROOTS.

Roots,	1	2	3	4	5	6	7	8	9
Squares,	1	4	9	16	25	36	49	64	81
Cubes,	1	8	27	64	125	216	343	512	729
4th pow.	1	16	81	256	625	1296	2401	4096	6561
5th pow.	1	32	243	1024	3125	7776	16807	32768	59049
6th pow.	1	64	729	4096	15625	46656	117649	262144	531441

To extract the Square Root.

RULE.

1. Distinguish the given number into periods of two figures each, beginning at the place of units, and marking every second figure from the place of units to the left, in whole numbers, and from the decimal point to the right in decimals, if any, annexing a cypher to the decimals, if necessary to make an even number of places.

2. Begin with the left hand period, and find by trial the greatest square it contains, and set its root on the right hand of the given number, separated from it by a curve line, for the first figure of the required root.

3. Subtract the square thus found from the said period, and to the remainder bring down and annex the next period, for a dividend.

4. Double the root already found, for a defective divisor.

5. Find how often the defective divisor is contained in the dividend, exclusive of its right hand figure; and the figure denoting that number of times, will be the next figure of the root, *probably*.

6. Complete the divisor, by annexing at the right hand of it the last figure of the root.

7. Multiply the divisor so completed by the last figure of the root, and subtract the product from the dividend.

8. Bring down another period, and find another figure of the root in the same manner; and so on, through all the periods.

Note 1. The reason for dividing the given number into periods of two figures each, is, that the square of any one figure is never more than two figures. Hence, there will be as many places of whole numbers in the root, as there were periods of whole numbers in the square.

Note 2. It will sometimes happen, that on multiplying the complete divisor by the last figure of the root, the product will be greater than the dividend. In that case, you must try the next lower figure, and if that prove too great, the next, and so on.

Note 3. When you have proceeded through all the periods of the given number, and there is a remainder, the operation may be continued further, if required, and another figure of the root found, by annexing two cyphers to that remainder, and proceeding as before. If that remainder consisted of whole numbers, the first figure found by annexing a period of cyphers, will be the first decimal, and so on.

Note 4. The square root of a vulgar fraction may be found by reducing it to its lowest terms, and extracting the root of each term.

Or, the numerator and denominator of the given fraction may be multiplied together, and the square root of that product, being extracted, may be made the numerator to the denominator of the given fraction, or the denominator to the numerator of it, for the answer.

But if the exact root of it cannot be found by either of these methods, an approximation to it may be found, by reducing the vulgar fraction to a decimal, and extracting its root to as many places as shall be thought necessary.

Note 5. A mixed number in vulgar fractions must be reduced to a mixed number in decimals, and the root extracted as before.

Proof.

Square the root, when found, and add in the remainder, if any; and the sum will be equal to the given number, if the work is right.

Example.

What is the square root of 552·25?

Operation.	*Explanation.*
. . .	1. I distinguish the given number
552·25(23·5 *Ans.*	into periods of two figures each, be-
4	ginning at the place of units, and
—	marking every second figure each way;
43)152	and have three periods, the first con-
129	sisting of 5, the second of 52, and the
----	third of ·25.
465)2325	2. I take the left hand period, which
2325	is 5, and try how great a square num-

ber I can find in it, which is 4, the root of which is 2. So I set down 2 for the first figure of the required root.

3. I set down 4, the square thus found, under 5, the first period, and subtract; and the remainder is 1. To this remainder, I bring down and annex the next period, 52; and I have 152 for a dividend.

4. I double 2, the root already found, and it makes 4, which I set down at the left of the dividend, for a defective divisor.

5. I seek how often 4, the defective divisor, is contained in 15, the dividend with the exception of the right hand figure; 4 in 15 is 3 times. So I set down 3 for the second figure of the root.

6. I now complete the divisor, by annexing at the right hand of 4, the defective divisor, 3, the second figure of the root; and it makes 43.

7. I multiply 43, the divisor so completed, by 3, the second figure of the root; and it makes 129, which I subtract from the dividend, 152; and the remainder is 23.

8. To this remainder, 23, I bring down and annex the next period, 25; and it makes 2325, for a dividend.

9. I double the root already found, 23, for a defective divisor; and it makes 46.

10. I seek how often 46 is contained in 232, which is the dividend excepting its right hand figure; and find it 5 times. So I set down 5 for the third figure of the root.

11. I now complete the divisor, by annexing at the right hand of 46, the defective divisor, 5, the third figure of the root; and it makes 465.

12. I multiply 465, the divisor so completed, by 5, the third figure of the root; and it makes 2325, which being subtracted from the dividend, there is no remainder.

The figures of the root, therefore, are 235. But as I had in the given number only two periods of whole numbers, I must have only two whole numbers in the root. So I insert a decimal point between the second and third figures, and the answer is 23·5.

To prove the operation, I square the root so found; that is, I multiply 23·5 by 23·5, and it makes 552·25; which being equal to the given number, I conclude the work is right.

Note 6. The areas of similar figures are to each other as the squares of their similar dimensions.

EXAMPLE.

If a certain field, one side of which measures 30 rods, contains 6 acres, how much does another field contain, of the same shape, the similar side of which measures 50 rods?

Operation.

30 50
30 50
--- ---
900 : 2500 :: 6 :
6
------
900)15000(16·66+ *Ans.*
900

6000
5400

6000
5400

6000
5400

600

Note 7. The square of the longest side of a right angled triangle is equal to the sum of the squares of the other two sides.

EXAMPLE.

The height of a certain wall is 17 feet, and there is a ditch at the foot of it 20 feet wide; how long must a ladder be, to reach from the outside of the ditch to the top of the wall?

Operation.

17 height of wall.	20 width of ditch.
17	20
---	---
119	400 square of width.
17	289 square of height.
----	----
289 square of height.	689 sum, and square of the

length of the ladder; the square root of which being extracted, is 26·24+ feet, which is the answer.

PROBLEM.

The sum and product of two numbers being given, to find the numbers.

RULE.

From the square of the sum, subtract four times the product, and the square root of the remainder will be the difference of the numbers.

EXAMPLE.

A and B make up 1000 dollars, and trade till they have gained two hundred per cent, which gain is to be divided in proportion to the share of each in the capital stock. A's gain is the most, and is such a sum, that if multiplied by B's, the product would be 960000 dollars. What was each man's share of the capital stock?

Operation.

Here, the gain, being 200 per cent on the capital stock, is 2000 dollars; and the product of the two parts is 960000 dollars. Therefore,

2000	960000
2000	4
------	--------
4000000 is the square of the sum.	3840000

3840000 is 4 times the product.

```
---------
160000(400 is the difference.
16
---
   0000
```

Having found the difference, I add half the difference to half the sum for the greater, and subtract for the less; and each person's share of the gain is, A's, 1200 dollars, and B's, 800 dollars; consequently their shares of stock were, A's, 600 dollars, and B's, 400 dollars.

QUESTIONS ON THE FOREGOING.

What is involution?
What is a power?
What is a root?
What is a square? The square root?
What is a cube? The cube root?
What is a biquadrate? The biquadratic root?
What is the rule for finding any given power?
How is a vulgar fraction involved?
What is evolution?
What is a rational number?
What is a surd?
In extracting the square root, what is the first thing to be done?
Where do you begin to point off?
How many figures do you put in a period, and why?
How many whole numbers will there be in the root?
How do you find the first figure of the root?
Of what does the first dividend consist?
Of what does the defective divisor consist?
When you have found the defective divisor, how do you find another figure of the root?
How do you complete the divisor?
By what do you multiply?
What do you do next?
What if the product to be subtracted is larger than the dividend, from which it is to be subtracted?
How do you form another dividend?
When you have extracted the root of the given number, and there is a remainder, how can you extend the operation further?
What is the first method of extracting the square root of a vulgar fraction?
The second? The third?
How do you extract the square root of a mixed number in vulgar fractions?
How do you prove the operation?
How do you know the work is right?
What proportion have the areas of similar figures to each other?
What proportion have the sides of a right angled triangle to each other?
When the sum and product of two numbers are given, how do you find the difference?
When you have found the difference, how do you find the numbers?

To extract the Cube Root.

RULE.

1. Distinguish the given number into periods of three figures each, beginning at the place of units, and marking every third figure to the left in whole numbers, and to the right in decimals, if any, adding cyphers to the decimals, if necessary, to make out the last period.

2. Begin with the left hand period, and find by trial the greatest cube it contains, and set its root on the right hand of the given number, for the first figure of the required root.

3. Subtract the cube thus found from the said period, and to the remainder bring down and annex the next period, for a dividend.

4. Take three times the square of the root already found, for a divisor.

5. Divide the dividend by the divisor, so far as to find one quotient figure, which will be the second figure of the root, *probably*.

6. Subtract the cube of these two figures of the root from the two left hand periods of the given number, and to the remainder bring down and annex the third period, for a second dividend.

7. Find another divisor, and another figure of the root, in the same manner, and so on, always subtracting the cube of the root found from as many of the left hand periods of the given number, as you have found figures of the root.

Note 1. The reason for dividing the given number into periods of three figures each, is, that the cube of any one figure is never more than three figures. Hence, there will be as many places of whole numbers in the root, as there were periods of whole numbers in the given number.

Note 2. It will sometimes happen, that the cube of the figures placed in the root will be found greater than the periods from which it is to be subtracted. In that case, the last number placed in the root is too large, and must be made smaller.

Note 3. When you have proceeded through all the periods of the given number, and there is a remainder, the operation may be continued further, if required by annexing three cyphers to that remainder, and proceeding as before.

Note 4. The cube root of a vulgar fraction may be found by reducing it to its lowest terms, and extracting the root of each term. But if the exact root of each term cannot be found, an approximation may be made towards it, by reducing the fraction to a decimal, and extracting its root, to as many places as shall be requisite.

Note 5. The cube root of a mixed number in vulgar fractions, may be found, by reducing it to a mixed number in decimals, and then extracting the root.

PROOF. Cube the root, when found, and add in the remainder, if any; and the sum will be equal to the given number, if the work is right.

EXAMPLE. What is the cube root of 34328·125?

Operation.

```
. . .
34328·125(32·5 Ans.
27
---
27)7328 first dividend.
---
32768 cube of 32.
---
3072)1560125 second dividend.
---------
34328125 cube of 32·5.
```

Explanation.

1. I distinguish the given number into periods of three figures each, beginning at the place of units, and marking every third figure each way; and have three periods, the first consisting of 34, the second of 328, and the third of ·125.

2. I take the left hand period, which is 34, and try how great a cube I can find in it, which is 27, the root of which is 3; so I set down 3 for the first figure of the required root.

3. I set down 27, the cube thus found, under 34, the first period, and subtract, and the remainder is 7. To this remainder, I bring down and annex the next period, 328, and I have 7328 for a dividend.

4. I square 3, the root already found, and it makes 9; and multiply that by 3, and it makes 27, which I set down at the left hand of the dividend, for a divisor.

5. I seek how often 27, the divisor, is contained in 7328, the dividend, and find the first quotient figure to be 2. So I set down 2 for the next figure of the root.

6. I cube 32, the root already found, and it makes 32768, which I subtract from 34328, the two left hand periods of the given number, and the remainder is 1560, to which I bring down and annex 125, the third period, and it makes 1560125 for the second dividend.

7. I square 32, the root already found, and it makes 1024; and multiply that by 3, and it makes 3072, for the second divisor.

8. I seek how often 3072, the second divisor, is contained in 1560125, the second dividend, and find the first quotient figure to be 5. So I set down 5 for the third figure of the root.

9. I cube 325, the root found, and it makes 34328125, which I subtract from 34328125, the given number, and nothing remains. So that 325 are the figures of the root. But because there were two periods of whole numbers, and one of decimals, in the given number, there must be two whole numbers and one decimal in the answer; and I place the decimal point accordingly, and the answer is 32·5.

To extract any root.

The rule for extracting the cube root will serve for extracting any root, with a little variation, as follows:

1. Distinguish the given number into periods of as many figures each, as is the root to be extracted; that is, for the fourth root, into periods of four figures each; for the fifth, five, &c.

2. Begin with the left hand period, and find by trial the greatest power of the same name with the required root, that is, the fourth power for the fourth root, the fifth power for the fifth root, &c. and set the root of that power on the right hand of the given number, for the first figure of the root.

3. Subtract the power thus found from the said period, and to the remainder bring down and annex the next period for a dividend.

4. If the required root is the fourth, take four times the cube of the root already found, for a divisor; if it is the fifth, take five times the fourth power; if the sixth, take six times the fifth power, &c.

5. Divide the dividend by the divisor, so far as to find one quotient figure, which will be the next figure of the root, *probably*.

6. Raise these two figures of the root to the power which is of the same name with the required root, and subtract the said power from the two left hand periods of the given number, and to the remainder bring down and annex the third period, for a second dividend.

7. Find another divisor, and another figure of the root, in the same manner; and so on, always subtracting the power found from as many of the left hand periods of the given number, as you have found figures of the root.

EXAMPLE 1. What is the 5th root of 5153632?

Operation.

5153632(22 *Ans.*
32

80)1953632 first dividend.

5153632 5th power of 22.

EXAMPLE 2. What is the fourth root of 221533456?

Operation.

221533456(122 *Ans.*
1

4)12153 first dividend.

20736 4th power of 12.

6912)14173456 second dividend.

221533456 4th power of 122.

Note. The observations in the notes under the rule for extracting the cube root, will apply to this rule for extracting any root, with variations similar to those in the rule.

Questions on the foregoing.

In extracting the cube root, what is the first thing to be done?
Where do you begin to point off?
How many figures do you put in a period, and why?
How many whole numbers will there be in the root?
How do you find the first figure of the root?
Of what does the first dividend consist?
Of what does the divisor consist?
When you have found the divisor, how do you find another figure of the root?
How do you form a second dividend?
How do you find a third figure of the root?
From how many periods of the given number, must you always subtract?
What if the cube of the figures placed in the root is greater than the periods from which it is to be subtracted?
When you have extracted the cube root of the given number, and there is a remainder, how can you extend the operation further?
What is the first method of extracting the cube root of a vulgar fraction?
What is the second method?
How do you extract the cube root of a mixed number in vulgar fractions?
How do you prove the operation?
How do you know the work is right?
What is the rule for extracting any root?

Exercise 65.

Tell what is the	*Ans.*	Tell what is the	*Ans.*
Square of 3,	9	Sum of the squares of 5 and 6,	61
Cube of 2,	8	Cube of the square of 2,	64
Square root of 16,	4	Sum of the cubes of 2 and 3,	35
Cube root of 27,	3	Difference of the square and cube of 2,	4
Square of 9,	81	Difference of the square and cube of 3,	18
Cube of 4,	64	Sum of the square & cube of 2,	12
Cube root of 8,	2	Sum of 3 and the square of 3,	12
Square root of 64,	8	Square root of the cube of the square of 2,	8
Cube of 5,	125	Product of the square and cube of 2,	32
Square of 11,	121	Quotient of the cube of 2 by the square of 2,	2
Cube root of 64,	4		
Square root of 25,	5		
Square root of 144,	12		
Square of the sum of 2 and 3,	25		
Square of the square of 3,	81		

Exercise 66.

Tell what is the	*Ans.*
Square of the sum of 4 and 5,	81
Sum of the squares of 4 and 5,	41
Difference of the cubes of 2 and 3,	19
Sum of the cubes of 2 and 4,	72
Sum of the square roots of 64 and 100,	18
Square root of the sum of the square roots of 36 & 100,	4
Square of the difference of the square roots of 64 & 25,	9
Cube of the difference of the square roots of 49 and 16,	27
Add 1 to 5×7, and tell the square root,	6
Square root of the sum of the squares of 3 and 4,	5
Sum of the square of 8 and cube of 2,	72

EXERCISE 67.

Add 4 to 5×9, and tell the square root,	*Ans.* 7.
Add 1 to 7×9, and tell the square root,	8
Subtract 20 from 7×8, and tell the square root,	6
Add 2 to the square of 5, and tell the cube root,	3
Subtract 8 from the cube of 4, and tell the seventh,	8
Subtract 5 from 6×9, and tell the square root,	7
Add 5 to the square of 5, and tell the tenth,	3
Subtract 4 from the square of 5, and tell the cube of 1 seventh,	27
Add 2 to the cube root of 8, and tell the difference between its square and cube,	48
Subtract 1 from the square root of 4, and tell the sum of its square and cube,	2
Tell 5 times the sum of the squares of 3 and 4,	125
One third of the sum of the cubes of 2 and 4,	24
Half the difference of the cubes of 3 and 2,	$9\frac{1}{2}$
Subtract the square of 5 from the cube of 5, and tell the square root,	10
Subtract the square of 4 from the cube of 4, add 1, and tell the square root,	7
Add the square of 3 to the square of 4, subtract 5, & tell the 4th,	5
Tell one half of one tenth of the square of 10,	5
One half of two thirds of the square of 6,	12
Two thirds of one half of the square of 12,	48
One half of two thirds of three fourths of the square of 10,	25
Add the odd numbers below 10, and tell the cube of the square root,	125

EXERCISE 68.

Add 3 and 4 and 5 to 5 times 5,	*Ans.* 37
Take 9 and 8 and 7 from 6 times 6,	12
Multiply 2 and 3 and 4 by 3 times 3,	81
Divide 9 and 5 and 10 and 20 by 11,	4
Add the sum of 6 and 11 to their difference,	22
From the sum of 8 and 13, take twice their difference,	11
Multiply the sum of 8 and 14 by half their difference,	66
Divide the sum of 22 and 14 by half their difference,	9
Add the sum of the squares of 2 and 3 to twice their difference,	23
From the sum of the squares of 3 & 4, take twice their difference,	11
Multiply the sum of the squares of 4 and 5, by one third of their difference,	123
Divide the sum of the square and cube of 3 by 4, and tell the square root,	3
Subtract 4 from the product of the square roots of 49 and 16, and tell the square of one half of it,	144
Subtract the square of 4 from the square of 5, and tell the square of it,	81
Multiply 1 and 2 and 3 and 4 and 5, by one fifth of it,	45
Add the square of 1 to the cube of 1, and tell the square of one oneth,	4

EXERCISE 69.

Tell the	*Ans.*
square of $\frac{2}{3}$,	$\frac{4}{9}$
cube of $\frac{1}{2}$,	$\frac{1}{8}$
square of $\frac{1}{4}$,	$\frac{1}{16}$
cube of $\frac{1}{3}$,	$\frac{1}{27}$
square of $\frac{4}{3}$,	$1\frac{7}{9}$
cube of $\frac{3}{2}$,	$3\frac{3}{8}$
Sum of the squares of	
$\frac{1}{4}$ and $\frac{1}{2}$,	$\frac{5}{16}$
$\frac{1}{2}$ and $\frac{1}{3}$,	$\frac{13}{36}$
$\frac{1}{4}$ and $\frac{2}{5}$,	$\frac{89}{400}$

Tell the difference of the squares of	*Ans.*
$\frac{1}{3}$ and $\frac{1}{2}$,	$\frac{5}{36}$
$\frac{1}{2}$ and $\frac{1}{4}$,	$\frac{3}{16}$
$\frac{1}{4}$ and $\frac{1}{3}$,	$\frac{7}{144}$
Product of the squares of	
$\frac{1}{3}$ and $\frac{1}{4}$,	$\frac{1}{144}$
$\frac{1}{2}$ and $\frac{1}{5}$,	$\frac{1}{100}$
$\frac{1}{4}$ and $\frac{1}{2}$,	$\frac{1}{64}$
$\frac{1}{5}$ and $\frac{1}{4}$,	$\frac{1}{400}$
$\frac{1}{5}$ and $\frac{1}{5}$,	$\frac{1}{225}$
$\frac{2}{3}$ and $\frac{3}{5}$,	$\frac{36}{225}$

EXERCISE 70.

Tell what is the sum of	*Ans.*	Tell what is the sum of	*Ans.*
2 thirds of 18 & 3 fourths of 16,	24	2 fifths of 25 & 1 third of 33,	21
2 fifths of 35 & 5 sixths of 48,	54	3 fourths of 28 & 2 thirds of 18,	33
3 fourths of 40 & 2 thirds of 24,	46	3 eighths of 32 & 2 fifths of 15,	18
4 fifths of 35 & 3 fifths of 40,	52	3 sevenths of 35 & 2 fifths of 40,	31
2 fifths of 15 & 3 fifths of 30,	24	2 fifths of 25 & 2 eighths of 96,	34
3 sevenths of 21 & 2 thirds of 27,	27	3 fifths of 30 & 2 sevenths of 77,	40

EXERCISE 71.

From	take	*Ans.*
2 thirds of 24,	3 fourths of 12,	7
3 fourths of 32,	2 fifths of 15,	18
2 fifths of 35,	2 thirds of 12,	6
3 fifths of 55,	2 sevenths of 28,	25
2 thirds of 33,	2 ninths of 27,	16
2 fifths of 60,	3 sevenths of 21,	15
2 ninths of 36,	2 fifths of 15,	2
3 tenths of 80,	2 ninths of 45,	14
2 sevenths of 28,	2 ninths of 27,	2
3 fifths of 100,	4 fifths of 60,	12
2 sevenths of 140,	3 eighths of 96,	4

EXERCISE 72.

Multiply	by	*Ans.*
2 thirds of 9,	3 fourths of 12,	54
3 fifths of 15,	2 thirds of 18,	108
4 fifths of 25,	1 tenth of 30,	60
2 sevenths of 21,	1 twelfth of 24,	12
3 fifths of 25,	2 thirds of 9,	90
2 thirds of 12,	3 fifths of 15,	72
3 fourths of 8,	2 thirds of 12,	48
2 fifths of 20,	2 fifths of 15,	48
5 sixths of 30,	2 sevenths of 21,	150
3 sevenths of 28,	2 ninths of 27,	72

EXERCISE 73.

Divide	by	*Ans.*
2 thirds of 36,	2 sevenths of 21,	4
3 fourths of 24.	2 ninths of 27,	3
4 fifths of 30,	3 fourths of 16,	2
5 sixths of 18,	1 ninth of 45,	3
2 fifths of 60,	3 eighths of 16,	4
3 fourths of 48,	3 sixths of 18,	4
4 fifths of 60,	2 ninths of 27,	8
3 sevenths of 42,	3 eighths of 16,	3
2 thirds of 72,	2 sevenths of 42,	4
3 fourths of 48,	3 eighths of 24,	4

EXERCISE 74.

Divide the sum of	by	*Ans.*
2 thirds of 24 and 1 half of 18,	5,	5
2 thirds of 30 and 3 fourths of 32,	4,	11
1 fourth of 48 and 2 thirds of 24,	7,	4
3 fourths of 16 and 2 fifths of 60,	6,	6
4 fifths of 20 and 2 fifths of 30,	7,	4
2 sevenths of 28 & 3 sevenths of 14,	2,	7
3 eighths of 40 and 3 sevenths of 35,	6,	5
2 thirds of 36 and 3 fourths of 24,	7,	6

EXERCISE 75.

From	take	and divide by	*Ans.*
2 thirds of 36,	1 fifth of 40,	4,	4
2 thirds of 24,	1 fourth of 24,	5,	2
2 fifths of 45,	2 ninths of 27,	4,	3
3 fourths of 44,	3 sevenths of 21,	3,	8
3 eighths of 64,	3 eighths of 24,	5,	3
2 ninths of 108,	1 ninth of 36,	4,	5
3 sevenths of 77,	1 seventh of 35,	4,	7
4 fifths of 95,	4 ninths of 45,	7,	8

EXERCISE 76.

From	take	and multiply by	*Ans.*
2 thirds of 45,	3 fifths of 20,	3,	54
3 fourths of 16,	5 sixths of 12,	9,	18
6 sevenths of 42,	7 eighths of 32,	5,	40
5 sixths of 36,	6 sevenths of 28,	9,	54
3 fifths of 55,	4 fifths of 35,	5,	25
8 tenths of 50,	3 tenths of 60,	3,	66
6 sevenths of 28,	5 ninths of 36,	7,	28
7 eighths of 48,	6 sevenths of 42,	9,	54
2 fifths of 35,	3 eighths of 32,	12,	24
3 fourths of 44,	8 ninths of 27,	6,	54
4 fifths of 30,	6 sevenths of 21,	8,	48

ARITHMETICAL PROPORTION,

Is the relation between two numbers with respect to their difference.

Four quantities are in arithmetical proportion, when the difference between the first and second is equal to the difference between the third and fourth. Thus, 4, 6, 7, 9, are in arithmetical proportion, because the difference between 4 and 6, the first and second, is 2; and the difference between 7 and 9, the third and fourth, is also 2.

ARITHMETICAL PROGRESSION,

Is a continued arithmetical proportion, or it is a series of numbers which increase or decrease by a common difference, as, 2, 4, 6, 8, 10, 12, &c.; or, 20, 16, 12, 8, 4, &c.

The first and last terms are called extremes.

In any series of numbers in arithmetical progression, the sum of the two extremes is equal to the sum of any two terms equally distant from them, or to twice the middle term, if the number of terms is unequal.

Case 1.

To find the sum of all the terms, when the first term, the last term, and the number of terms, are given.

Rule.

Multiply the sum of the two extremes by half the number of terms, and the product is the sum of all the terms.

Example. How many strokes does a clock strike in 12 hours?

Operation.

1 first term.
12 last term.

13 sum of the two extremes.
6 half the number of terms.

78 *Ans.*

Case 2.

To find the number of terms, when the first and last terms, and common difference, are given.

Rule.

Divide the difference of the extremes by the common difference, add 1 to the quotient, and it will be the number of terms.

EXAMPLE. If a man gave his youngest child 20 dollars, the next 40, and so on, increasing to the eldest, who had 100, how many children had he?

Operation.

100 last term.
20 first term.

com. diff. 20)80 difference of the extremes.

4+1=5, *Ans.*

CASE 3.

To find the common difference, when the first and last terms, and number of terms, are given.

RULE.

Divide the difference of the extremes by one less than the number of terms, and the quotient will be the common difference.

EXAMPLE. A man had 10 sons, whose ages differed alike; the youngest was 3 years old, and the eldest 48. What was the common difference?

Operation.

number of terms, 10 48 greater extreme.
1 3 less extreme.

divisor 9)45 difference of the extremes.

5 *Ans.*

CASE 4.

To find the last term, when the first term, the common difference, and number of terms, are given.

RULE.

Multiply the common difference by that number which is one less than the number of terms; then, if the series is increasing, add the first term to that product, and the sum will be the last term; but if the series is decreasing, subtract that product from the first term, and the remainder will be the last term.

EXAMPLE 1. If a man travels 4 miles the first day, and 7 the second, and so on, increasing 3 miles each day, how far will he travel the 20th day?

3 common difference.
19 one less than the number of terms.

57 product.
4 first term.

61 *Ans.*

EXAMPLE 2. If a man travels 61 miles the first day, and 58 the second, and so on, decreasing 3 miles each day; how far will he travel the 20th day?

3 common difference.	61 first term.
19 one less than the number of terms.	57 product.
57 product.	4 *Ans.*

GEOMETRICAL PROGRESSION,

Is a series of numbers which increase or decrease by a common multiplier or divisor, called the ratio, as 2, 4, 8, 16, 32, 64, &c. which increase by the common multiplier 2; or, 486, 162, 54, 18, 6, 2, which decrease by the common divisor 3.

In any series of numbers in geometrical progression, the product of the two extremes is equal to the product of any two terms equally distant from them, or to the square of the middle number, if the number of terms is unequal.

CASE 1.

To find the last, or any other remote term; the first term, the number of terms, and the ratio, being given.

RULE.

Involve the ratio to that power which is one less than the number of terms, and multiply the power so found by the first term, and the product will be the term required.

EXAMPLE. A man hired a laborer for one year, promising to give him 2 dollars for the first month, 4 for the second, 8 for the third, and so on; what was his wages for the last month?

Operation. The ratio is 2, which is to be involved to its 11th power, because 12 is the number of the term sought. The 11th power of 2 is 2048, which being multiplied by 2, the first term, gives 4096 for the 12th term, or the wages of the last month.

CASE 2.

To find the sum of the series; the first term, the last term, and the ratio, being given.

RULE.

Multiply the last term by the ratio, from the product subtract the first term, and divide the remainder by that number which is one less than the ratio, and the quotient will be the sum of all the terms.

EXAMPLE. According to the terms of the preceding question, what is the wages of the laborer for the whole year?

Operation. The first term is 2, the ratio 2, the number of terms 12, and the last term 4096, as found by Case 1. Now, I multiply 4096, the last term, by 2, the ratio, and the product is 8192; from this I subtract 2, the first term, and the remainder is 8190. This is to be divided by that number which is 1 less than the ratio; but as the ratio is 2, the number which is 1 less than it, is 1; and 8190 divided by 1, gives 8190 dollars for the answer.

QUESTIONS ON THE FOREGOING.

What is arithmetical proportion?
What is arithmetical progression?
What are the extremes?
To what is the sum of the two extremes equal?
How do you find the sum of all the terms?
How do you find the number of terms?
How do you find the common difference?
How do you find the last term?
What is geometrical progression?
To what is the product of the extremes equal?
What is the rule for finding the last term?
How do you find the sum of the series?

ALLIGATION,

Is a rule which teaches how to mix together several ingredients of different values or qualities, so that the mixture may be of some intermediate value or quality.

CASE 1.

To find the value or quality of the mixture, when the quantities, and values, or qualities, of the several ingredients of which it is composed, are given.

RULE.

Multiply the quantity of each ingredient by its value or quality; then say: As the sum of the quantities of the several ingredients, is to the sum of the several products; so is any given quantity of the mixture, to its value.

EXAMPLE. A mixture being made of 5*lbs.* of tea, worth 7*s.* a *lb.*; 9*lbs.* worth 8*s.* 6*d.* a *lb.*; and 14½*lbs.* worth 5*s.* 10*d.* a *lb.*: what is a *lb.* of it worth?

Operation.

lbs.	*d.*	
5	× 84	= 420
9	×102	= 918
14·5	× 70	=1015
Sum of the quantities, 28·5		)2353 sum of the products.

lb. *d.* *lb.*

Therefore, 28·5 : 2353 :: 1 : 82½*d.*=6*s.* 10½+*d.* *Ans.*

Explanation. I set down the quantity or number of *lbs.* 5, 9, and 14½, in a convenient column for addition, expressing the half *lb.* by a decimal, for greater convenience. Opposite to each quantity, I set its value, reduced to pence, because the value of one sort was partly pence; 84, 102, and 70. I then set, in a third column, the several products formed by multiplying each quantity by its value, 420, 918, and 1015. I then find the sum of the quantities, which is 28·5*lbs.*, and the sum of the products, which is 2353; and say, as 28·5, the sum of the quantities, is to 2353, the sum of the products; so is 1, the given quantity, to its value. Which proportion being worked out, gives 82*d.* 2*q.*, or 6*s.* 10*d.* 2*q.* for the value of a *lb.*; which is the answer.

CASE 2.

When the values of several ingredients are given, to find how much of each will make a mixture of a given value.

RULE.

1. Set the values of the ingredients in a column under each other, and the value of the mixture at the left.

2. Consider which of the values of the ingredients are greater than that of the mixture, and which less; and connect each greater with one less, and each less with one greater.

3. See what the difference is between the value of each ingredient and that of the mixture, and set down that difference opposite to the value with which such ingredient is connected.

4. Then, if only one difference stands against any value, that will be the quantity belonging to that value; if more than one, their sum will be the quantity.

Note 1. If all the given values of the ingredients are greater or less than that of the mixture, they must be linked with a cypher.

Note 2. Questions of this kind will admit of as many answers as there can be different modes of connecting the values, or of dividing them by a common divisor, or multiplying them by a common multiplier; for which reason they are called *indeterminate*, or *unlimited* problems.

EXAMPLE. How much oats, at 2*s.* 6*d.*, barley at 3*s.* 8*d.*, corn at 4*s.*, and rye at 4*s.* 8*d.* per bushel, must be mixed together, that the compound may be worth 3*s.* 10*d.* per bushel?

Operation.

d.	*d.*	*bush.*	
46	30	10 oats,	*Ans.*
	44	2 barley,	
	48	2 corn,	
	56	16 rye,	

Explanation.

1. I set down 46*d.* the value of the mixture, and at the right of it, in a column, 30*d.* the value of the oats, 44*d.* that of the barley, 48*d.* that of the corn, and 56*d.* that of the rye.

2. I consider which of them are greater, and which less than 46, the value of the mixture, and connect them accordingly, each greater with one less, and each less with one greater; that is, 48, a greater, with 44, a less, and 56, a greater, with 30, a less.

3. I see what the difference is between the value of each ingredient, and that of the mixture; and I find that 16 is the difference between 30 and 46. So I set down 16 opposite to 56, with which 30 is connected. 2 is the difference between 44 and 46; and I set down opposite to 48, with which 44 is connected. 2 is the difference between 48 and 46; and I set down 2 opposite to 44, with which 48 is connected. 10 is the difference between 56 and 46; and I set down 10 opposite to 30, with which 56 is connected.

4. Now, as I have only one difference opposite to each value, that is the quantity belonging to that value; that is, there must be 10 bushels of oats, 2 of barley, 2 of corn, and 16 of rye.

Again: The operation may be varied, and a different answer produced, by connecting the values in a different manner, as follows:

d.	*d.*	*bush.*	
46	30	2 oats,	*Ans.*
	44	10 barley,	
	48	16 corn,	
	56	2 rye,	

And again, as follows:

d.	*d.*	*bush.*	
46	30	10+2=12 oats,	*Ans.*
	44	2 = 2 barley,	
	48	16+2=18 corn,	
	56	16 =16 rye,	

And so on indefinitely.

PROOF. Case 1 and 2 prove each other.

CASE 3.

When the whole mixture is to consist of a certain quantity.

RULE.

Find the quantity of each ingredient, by Case 2; and then say, as the sum of the quantities thus found, is to the given quantity; so is the quantity of each ingredient thus found, to the quantity required of each.

EXAMPLE. How much oats, at 2*s.* 6*d.*, barley at 3*s.* 8*d.*, corn at 4*s.*, and rye at 4*s.* 8*d.* per bushel, must be mixed together, to form a mixture of 90 bushels, worth 3*s.* 10*d.* per bushel?

Operation.

d.	*d.*	*bush.*	
46	30	10 oats,	*Ans.*
	44	2 barley,	
	48	2 corn,	
	56	16 rye,	
		30 total.	Therefore,

30 : 90 :: 10 : 30, oats,
30 : 90 :: 2 : 6, barley & corn each, } *Ans.*
30 : 90 :: 16 : 48, rye,

In this example, I proceed as before; and find that 10 bushels of oats, 2 of barley, 2 of corn, and 16 of rye, would make a mixture worth 3*s.* 10*d.* per bushel. But 10+2+2+16 is only 30, whereas I wanted the whole to be 90 bushels. So I say, as 30, the sum of the quantities thus found, is to 90, the given quantity; so is 10, the quantity of oats thus found, to 30, the quantity of oats required; and so of the rest.

CASE 4.

When one of the ingredients of which the mixture is composed, is limited to a certain quantity.

RULE.

Find the difference between the values of the several ingredients, and that of the mixture, and arrange them as in Case 2; and then say, as the difference which stands opposite to that ingredient whose quantity is given, is to the rest of the differences severally; so is the quantity given, to the several quantities required.

EXAMPLE. How much oats, at 2*s.* 6*d*, per bushel, barley at 3*s.* 8*d.*, and corn at 4*s.*, must be mixed with 24 bushels of rye, at 4*s.* 8*d.* that the mixture may be worth 3*s.* 10*d.* per bushel?

Operation.

d.	*d.*	*bush.*
46	30	10 oats,
	44	2 barley,
	48	2 corn,
	56	16 rye.

Then, 16 : 10 :: 24 : 15, oats; } *Ans.*
16 : 2 :: 24 : 3, barley & corn each,

In this example, I proceed as before; and find that 10 bushels of oats, 2 of barley, 2 of corn, and 16 of rye, would make a mixtuer worth 3*s.* 10*d.* per bushel. But as there is to be 24 bushels of rye,

instead of 16, the quantity of each of the other simples must be increased proportionally. So I say, as 16, the difference which stands opposite to the rye, is to 10, the difference which stands opposite to the oats; so is 24, the given quantity of the rye, to 15, the quantity of oats required; and so of the rest.

Questions on the foregoing.

What is alligation?
What is the first case? What is the rule?
What is the second case?
How do you arrange the several values?
In what manner do you connect them?
What is to be done, if all the values of the ingredients are greater, or all less than that of the mixture?
After the values are connected, what is to be done next?
When one difference stands opposite to any value, what is the answer?
What when there are more?
What are questions of this kind called, and why?
Of how many answers do they admit?
What is the method of proof?
What is the third case? The rule?
The fourth case? The rule?

POSITION,

Is a method of performing certain questions, by the supposition of false numbers, by working with which, the true numbers are found.

SINGLE POSITION,

Is that by which a question is performed by means of one supposition only.

Note. Questions which have their results proportional to their suppositions, belong to this rule.

Rule.

Take any number, and perform the same operation with it, as is described in the question; and then say, as the result of said operation is to the number taken, so is the result in the question, to the number sought.

Example. A person, after spending $\frac{1}{3}$ and $\frac{1}{4}$ of his money, has £60 left; what had he at first?

Operation.

Suppose he had £120. Then,

	£.	£.
$\frac{1}{3}$ of	120	is 40
and $\frac{1}{4}$ of	120	is 30

their sum is £70, which being taken from £120, leaves £50. Then, 50 : 120 :: 60 : 144£. *Ans.*

Proof.

$\frac{1}{3}$ of 144 is 48
$\frac{1}{4}$ of 144 is 36

their sum is £84, which being subtracted from £144, leaves £60, as by the question.

DOUBLE POSITION,

Is that by which a question is performed by means of two suppositions.

Note Questions which have their results not proportional to their suppositions, belong to this rule.

RULE.

1. Take any two numbers, and proceed with each of them separately according to the conditions of the question, as in single position; and find how much each result is different from the result mentioned in the question, calling these differences the *errors*, noticing also whether the results are too great or too little.

2. Multiply the first supposition by the last error, and the last supposition by the first error.

3. If the errors are like, divide the difference of the products by the difference of the errors; but if unlike, divide the sum of the products by the sum of the errors; and the quotient will be the answer, or true number sought.

Note. The errors are said to be *like*, when they are both too great, or both too little; but *unlike*, when one is too great, and the other too little.

EXAMPLE 1. What number is that, which being multiplied by 6, the product increased by 18, and the sum divided by 9, the quotient will be 20?

Operation.

1. Suppose it to be 18. Then, 18×6 is 108, and 18 added to 108 is 126, and 126 divided by 9 is 14. But instead of 14, it ought to be 20, according to the terms of the question; therefore the error is 6 too little.

Again: Suppose the number to be 30. Then, 30×6 is 180, and 18 added to 180 is 198, and 198 divided by 9 is 22. But it ought to be 20; therefore the error is 2 too great.

2. Next, I multiply 18, the first supposition, by 2, the last error, and the product is 36; and I multiply 30, the last supposition, by 6, the first error, and the product is 180.

3. To know whether to take the sum or difference of these products and errors, for division, I consider whether the errors are like or unlike. As one was too great and the other too little, they are unlike; and I take the sums. The sum of 36 and 180, the products, is 216, which is the dividend; and the sum of 6 and 2, the errors, is 8, which is the divisor. And 216 divided by 8, gives 27 for the true number sought.

Proof. 27×6 is 162, and 18 added to 162 is 180, and 180 divided by 9 is 20, according to the terms of the question.

EXAMPLE 2. A man left 10000 dollars to his two sons, one aged 11, and the other 16, to be divided in such a manner that their respective shares being put out at simple interest at 4 per cent per annum, should amount to equal sums when they come of age. What are the shares?

Operation.

1. Suppose the youngest to have 4000 dollars; then the eldest will have 6000. The interest of 4000 dollars, at 4 per cent, for 10 years, is 1600 dollars; which makes the sum of the youngest 5600 dollars. The interest of 6000 dollars for 5 years, is 1200 dollars; which makes the sum of the eldest 7200 dollars. The sum of the youngest, therefore, is 1600 dollars too little; which is the first error.

Again: Suppose the youngest to have 4500 dollars; then the eldest will have 5500; and the amount of their shares will be 6300 and 6600, which makes the sum of the youngest still too little by 300 dollars.

2. Next, the suppositions multiplied by the errors, are, $4000\times300=1200000$, and $4500\times1600=7200\ 00$; and the difference of the products is 6000000, which being divided by 1300, the difference of the errors, gives $4615·3846, for the share of the youngest; and this subtracted from $10000, gives $5384·6154, for the share of the eldest.

Proof. To prove the operation, the interest of $4615·3846 for 10 years, at 4 per cent, is $1846·1538, which added to the principal, makes the amount $9461·5384; and the interest of $5384·6154 for 5 years at 4 per cent, is $1076·9230, which added to its principal, makes the amount $6461·5384; so that the sums are equal, according to the terms of the question.

QUESTIONS ON THE FOREGOING.

What is position?
What is single position?
What questions belong to single position?
What is the rule?
What is double position?
What questions belong to this rule?
What is the first thing to be done?
When are the errors said to be like or unlike?
When you have found the errors, what is to be done next?
If the errors are like, what is your divisor? Your dividend?
If they are unlike, what?

PERMUTATION,

Is the changing of the position or order of things, or the showing of how many different ways they may be placed.

RULE.

Multiply all the terms of the natural series together, from 1 up to the given number, and the last product will be the answer.

EXAMPLE. How many days can 7 persons be placed in a different position at dinner?

Operation. 1×2 is 2, and 2×3 is 6, and 6×4 is 24, and 24×5 is 120, and 120×6 is 720, and 720×7 is 5040; which is the answer.

COMBINATION,

Is the showing of how many different ways a less number of things may be combined out of a greater.

RULE.

1. Multiply all the terms of the natural series together, from 1 up to the number to be combined, and make this product the divisor.

2. Take another series of numbers, of as many places, beginning with the number out of which the combination is to be made, and decreasing continually by 1; and multiply them together for a dividend.

3. Divide the dividend by the divisor, and the quotient will be the answer.

EXAMPLE. How many combinations can be made of 6 letters out of 10?

Operation.

$1\times2\times3\times4\times5\times6=720$, divisor;

$10\times9\times8\times7\times6\times5=151200$, dividend.

Then, 151200 divided by 720, gives 210, for the answer.

QUESTIONS ON THE FOREGOING.

What is permutation?
What is the rule?
What is combination?
How do you form your divisor?
How, your dividend?
What is the answer?

EXERCISE 77.

Divide 2 into 3 such parts, that the sum of their squares shall be $1\frac{1}{2}$, *Ans.* 1, $\frac{1}{2}$, and $\frac{1}{2}$.

Divide 1 into 3 such unequal parts, that the sum of their squares shall lack $\frac{1}{9}$ of being $\frac{1}{2}$. *Ans.* $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{6}$.

Divide 2 into 3 such parts, that they shall have the ratio of 5, 2, and 1. *Ans.* $1\frac{1}{4}$, $\frac{1}{2}$, and $\frac{1}{4}$.

Divide 2 into 3 such parts, that they shall have the ratio of 6, 3, and 1. *Ans.* $1\frac{1}{5}$, $\frac{2}{5}$, and $\frac{1}{5}$.

Divide 2 into 3 such parts, that the sum of their squares shall lack $\frac{1}{6}$ of $1\frac{2}{3}$. *Ans.* 1, $\frac{2}{3}$, and $\frac{1}{3}$.

Divide 2 into 3 such unequal parts, that the sum of their squares shall be $\frac{1}{8}$ more than $1\frac{1}{2}$. *Ans.* 1, $\frac{3}{4}$, and $\frac{1}{4}$.

Divide 1 into 3 such unequal parts, that the sum of their squares shall lack $\frac{1}{32}$ of $\frac{1}{2}$, *Ans.* $\frac{5}{8}$, $\frac{1}{4}$, and $\frac{1}{8}$.

Divide 1 into 2 such parts, that the difference of their squares shall be $\frac{1}{3}$. *Ans.* $\frac{2}{3}$, and $\frac{1}{3}$.

Divide 1 into 2 such parts, that the difference of their squares shall be $\frac{1}{2}$. *Ans.* $\frac{3}{4}$, and $\frac{1}{4}$.

Divide 5 into 2 parts, in the ratio of 1, and 2.
Ans. $1\frac{2}{3}$, and $3\frac{1}{3}$.

There are 2 numbers, and the difference between their sum, and the sum of their squares, lacks $\frac{1}{16}$ of being $\frac{1}{2}$; what are the numbers? *Ans.* $\frac{1}{2}$, and $\frac{1}{4}$.

Divide a shilling into 2 parts, so that one part shall be one farthing more than the other. *Ans.* $6\frac{1}{8}d.$ and $5\frac{7}{8}d.$

Divide 3*s.* 4*d.* into 2 parts, so that one part shall be $2\frac{1}{2}d.$ more than the other. *Ans.* 1*s.* $9\frac{1}{4}d.$ and 1*s.* $6\frac{3}{4}d.$

Divide a dollar into three parts, so that the largest shall be 8 cents more, and the smallest 7 cents less, than the middle part. *Ans.* 41 cents, 33 cents, and 26 cents.

SIMPLE INTEREST, BY DECIMALS.

Ratio is the simple interest of £1. or 1 dollar for 1 year, at any given rate, expressed as the decimal of a £. or a dollar. Thus, 5 per cent, is ·05; six per cent, ·06; six and a half per cent, ·065, &c.

CASE 1.

The principal, time, and ratio given, to find the interest.

RULE.

Multiply the principal, time, and ratio, continually together, and the product will be the interest.

EXAMPLE. What is the interest of 365£. 5*s.* for 10 years and 6 months, at 6 per cent?

Operation. The principal is £365·25, the time is 10·5*yr.* and the ratio is ·06, which being multiplied continually together, the answer is £230·1075, or £230 .. 2 .. $1\frac{3}{4}$.

Note. To find the amount, add the interest to the principal.

CASE 2.

The amount, time, and ratio given, to find the principal.

RULE.

Multiply the time by the ratio, and add 1 to the product for a divisor, by which divide the amount, and the quotient will be the principal.

EXAMPLE. What principal will amount to 3810*L.* in 6 years, at $4\frac{1}{2}$ per cent?

Operation. The time is 6, and the ratio is ·045; and their product is ·27; to which 1 being added, the divisor is 1·27. And the amount, £3810, being divided by 1·27, the quotient is £3000, which is the answer.

Note. This case is the same as discount. The principal found, being the same as the present worth.

CASE 3.

The amount, principal, and time given, to find the ratio.

RULE.

Subtract the principal from the amount, the remainder will be the interest. Divide the interest by the product of the time and principal, and the quotient will be the ratio.

EXAMPLE. At what rate per cent will 543£. amount to 705£. 18s. in 5 years?

Operation.

Principal, 543 amount, 705·9
time, 5 principal, 543·

2715) Int. 162·90(·06 ratio of 6 per cent.
162·90 *Ans.*

CASE 4.

The amount, principal, and rate per cent given, to find the time.

RULE.

Find the interest, and divide it by the product of the principal and ratio; the quotient will be the time.

EXAMPLE. In what time will 543£. amount to 705£. 18s. at 6 per cent?

Operation.

Principal, 543 amount, 705·9
ratio, ·06 principal, 543·

32·58) Int. 162·90(5 years. *Ans.*
162·90

COMPOUND INTEREST BY DECIMALS.

Ratio is the amount of £1, or $1, for 1 year, expressed in a decimal form.

CASE 1.

The principal, rate, and time given, to find the amount.

RULE.

1. Involve the ratio to such a power as is the same with the number of years.

2. Multiply the power so found, by the principal, and the product will be the amount.

Note. Having found the amount, subtract the principal from it, and the remainder will be the compound interest.

EXAMPLE. What is the amount of £300 for 4 years, at 5 per cent, compound interest?

Operation. The ratio is 1·05; of which the 4th power (because 4 is the number of years) is 1·21550625; and this being multiplied by 300, the principal, gives £364·651875, for the amount, which is the answer.

CASE 2.

The amount, rate, and time given, to find the principal.

RULE.

Divide the amount given by the ratio, involved to such power as is the same as the given number of years, and the quotient will be the principal.

EXAMPLE. What principal, at 5 per cent, compound interest, for 4 years, will amount to £364·651875?

Operation. The ratio is *L*1·05, and its 4th power *L*1·21550625, and 364·651875 divided by 1·21550625, gives 300*L*. for the answer.

Note. This case is the same as discount at compound interest, the principal found, being the same as the present worth.

CASE 3.

The principal, rate, and amount given, to find the time.

RULE.

Divide the amount by the principal, then involve the ratio till it equals the quotient, and the number of involutions will be the same as the number of years.

EXAMPLE. In what time will *L*450 amount to *L*520·93125, at 5 per cent, compound interest?

Operation. The amount, *L*520·93125, being divided by *L*450, the principal, gives 1·157625, for the quotient. The ratio, 1·05 involved to the 3d power, is 1·157625, which equals the quotient. So the answer is 3 years.

CASE 4.

The principal, amount, and time given, to find the rate per cent.

RULE.

Divide the amount by the principal, and extract such root of the quotient as is denoted by the number of years; which root will be the ratio.

EXAMPLE. At what rate per cent will 450*L*. amount to *L*520·93125, in three years?

Operation. 520·93125 divided by 450, gives 1·157625; and the cube root of 1·157625, is 1·05, the ratio of 5 per cent.

QUESTIONS ON THE FOREGOING.

In simple interest by decimals, what is meant by *ratio?*
How do you find the interest?
How, the principal? How, the ratio? The time?
Which case is the same as discount, and why?

In compound interest by decimals, what is meant by the *ratio?*
How do you find the amount? The compound interest?
The principal? the time? the rate per cent?
Which case is the same as discount, and why?

ANNUITIES.

An *annuity* is a sum of money payable every year, for a number of years, or forever.

When the annuity is not paid as it becomes due, it is said to be in *arrears.*

When the annuity is not to begin till after a certain time has elapsed, it is said to be in *reversion.*

The sum of all the annuities in arrears, together with the interest due upon each, is called the *amount.*

If an annuity is to be bought off, or paid all at once, the price which ought to be paid for it, is called the *present worth.*

ANNUITIES AT SIMPLE INTEREST.

CASE 1.

To find the amount of an annuity at simple interest.

RULE.

1. Make 1 the first term, and 1 the common difference, of a series of numbers in arithmetical progression, and make the number of terms one less than the number of years; and find the sum of the series.

2. Multiply that sum by one year's interest of the annuity, and the product will be the whole interest.

3. Multiply the annuity by the number of years, and add the whole interest so found, and the sum will be the amount sought.

Note. The reason for making the number of terms in the arithmetical series one less than the number of years, is, that there is no interest due upon the last year's annuity.

EXAMPLE. What is the amount of an annuity of 700 dollars for 6 years, allowing simple interest at 7 per cent?

Operation.

$1+2+3+4+5=15$ sum of the series.
49 interest of 700 dollars for 1 year.
735 whole interest.
$6\times700=4200$ six annuities.
$4935 amount.

Note. The reason of this operation will appear, if we consider that at the end of 6 years, there is due the first year's annuity, 700 dollars, and its interest for 5 years, that is 5 times 49 dollars, which is 245 dollars; the second year's annuity, 700 dollars, and its interest for 4 years, 196 dollars; the third year's annuity, 700 dollars, and its interest for 3 years, 147 dollars; the fourth year's annuity, 700 dollars, and its interest for 2 years, 98 dollars; the fifth year's annuity, 700 dollars, and its interest for 1 year, 49 dollars; and the sixth year's annuity, 700 dollars: all which added together, makes 4935 dollars, as before.

CASE 2.

To find the present worth of an annuity at simple interest.

RULE.

Find, as in discount, the present worth of each payment by itself, allowing discount to the time it becomes due, and the sum of all these will be the present worth sought.

EXAMPLE. What is the present worth of an annuity of 100 dollars, to continue 5 years, at 6 per cent per annum, simple interest?

Operation.

106 : 100 :: 100 : 94·3396, present worth of the 1st year's [annuity.
112 : 100 :: 100 : 89·2857, do. 2d do.
118 : 100 :: 100 : 84·7457, do. 3d do.
124 : 100 :: 100 : 80·6451, do. 4th do.
130 : 100 :: 100 : 76·9230, do. 5th do.

Ans. $425·9391, present worth of the whole.

ANNUITIES AT COMPOUND INTEREST.

CASE 1.

To find the amount of an annuity at compound interest.

RULE.

1. Make 1 the first term of a series of numbers in geometrical progression, and the amount of £1 or $1 for 1 year, at the given rate per cent, the ratio, expressing it in decimals.

2. Extend the series to as many terms as the number of years, and find its sum.

3. Multiply the sum thus found by the given annuity, and the product will be the amount required.

EXAMPLE. What is the amount of an annuity of 200 dollars, for 5 years, allowing compound interest, at 5 per cent?

Operation. The first term is 1; the ratio is 1·05. The first term being multiplied by the ratio, gives 1·05 for the second term; and that being multiplied by the ratio, gives 1·1025 for the third term; and that being multiplied by the ratio, gives 1·157625 for the fourth term; and that being multiplied by the ratio, gives 1·21550625 for the fifth term.

The sum of these five terms is 5·52563125, which being multiplied by 200, the annuity, gives $1105·12625 for the answer.

Note. To find the amount for additional parts of a year. Having found the amount for the whole years, find the interest of that amount for the given parts of a year, and add it.

CASE 2.

To find the present worth of an annuity at compound interest.

RULE.

1. Take the amount of £1 or $1 for 1 year, at the given rate per cent, and involve it to that power which is the same as the number of years, for a divisor.

2. Divide the annuity by this divisor, subtract the quotient so found from the annuity, and set down the remainder for a second dividend.

3. From the amount of £1 or $1 for 1 year, subtrac t 1 and take the remainder for a second divisor.

4. Divide the second dividend by the second divisor, and the quotient will be the present worth required.

EXAMPLE. What is the present worth of an annuity of 40 dollars, to continue 5 years, discount at 5 per cent per annum, compound interest?

Operation. 1. The amount of 1 dollar for 1 year at 5 per cent, is 1·05. This being involved to the 5th power, because 5 is the number of years, is 1·2762815625, which is the first divisor.

2. The annuity, 40 dollars, being divided by 1·2762815625, gives 31·34104, for the first quotient; which being subtracted from 40, the annuity, leaves 8·65896, for the second dividend.

3. From 1·05, the amount of 1 dollar for 1 year, I subtract 1, and the remainder is ·05, which is the second divisor.

4. The second dividend, 8·65896, being divided by ·05, the second divisor, gives $173·1792 for the present worth, which is the answer.

Note. To find the present worth for additional parts of a year: Having found the present worth for the whole years, find the present worth of that present worth, discount being allowed for the given parts of a year.

PERPETUITIES,

Are annuities which are to continue forever.

CASE 1.

To find the present worth of a perpetuity at compound interest.

RULE.

As the rate per cent, is to 100; so is the yearly payment, to the present worth.

EXAMPLE. What must I give for an annuity of 40 dollars, to continue forever, discounting at 5 per cent, compound interest.

Operation.

5 : 100 :: 40 :
100
—
5)4000
—
$800 *Ans.*

Note. To find what perpetuity can be purchased for a given sum, say, as 100 is to the rate per cent, so is the given sum, to the perpetuity it will purchase.

CASE 2.

To find the present worth of a perpetuity in reversion.

RULE.

1. Take the amount of £1 or $1 for 1 year, at the given rate per cent. and involve it to that power which is the same as the number of years before the annuity commences.

2. Multiply the power so found by the given interest of £1 or $1 for 1 year.

3. Divide the given annuity by the product so found, and the quotient will be the present worth required.

EXAMPLE. What must I give for a perpetuity of $40 per annum, to commence 5 years hence, discounting at 5 per cent?

Operation. The amount of $1 for 1 year, is 1·05; which being involved to the 5th power, is 1·2762815625; and 1·2762815625 multiplied by ·05, the interest of $1 for 1 year, is ·063814078125, which is the divisor; and $40 being divided by it, gives $626·8209+, for the present worth, or answer.

Question. A man has left an estate, which will yield $100 a year forever, to his two sons, A and B. A is to enter upon it immediately, and have the use of it 15 years; after which B is to have it forever. Whose portion is the most valuable, and how much the most, discounting at 5 per cent, compound interest?

Operation. The value of A's portion is equal to the present worth of an annuity of $100 for 15 years; and the value of B's portion is equal to the present worth of a perpetuity in reversion of $100, to commence after 15 years.

To find A's amount, I proceed as follows:

The amount of $1 for 1 year, is 1·05; which being involved to the 15th power, is 2·078928179+. Next, the annuity, $100, is to be divided by this power; which being done, the quotient is 48·1017098+. This quotient being subtracted from 100, the annuity, gives 51·8982901+ for the second dividend. Next, from 1·05, the amount of $1 for 1 year, I subtract 1·; and the remainder is ·05, for the second divisor. Lastly, I divide 51·8982901+, the second dividend, by ·05, the second divisor, and the quotient is $1037·9658+, the present worth of A's portion.

To find B's portion, I proceed as follows:

Here, again, I take 1·05, and involve it to the 15th power, which is 2·078928179+, as before. Next, I multiply this by ·05, the given interest of $1 for 1 year, and the product is ·10394640895+; by which I divide D100, the given annuity, and the quotient is D962·0341+, the present worth of B's portion. A's portion, therefore, is D1037·9658+; and B's, D962·0341+. Consequently, A's is the most valuable by 75 dollars, 93 cents, 1 mill, and 7 tenths of a mill.

Questions on the foregoing.

What is an annuity?
When is it said to be in arrears?
When, in reversion?
What is the amount?
What is the present worth?
What is the first case of annuities at simple interest?
In working that case, what is the first thing to be done?
The second? The third?
Of how many terms do you make your arithmetical series?
Why so?
What is the second case? the rule?
What is the first case of annuities at compound interest?
In working that case, what is the first thing to be done?
The second? The third?
How do you find the amount for additional parts of a year?
What is the second case?
In working the second case, what is the first thing to be done? The second? the third? the fourth?
How do you find the present worth of an annuity in reversion?
How, for additional parts of a year?
What are perpetuities?
What is the first case? The rule?
What is the second case?
In working the second case, what is the first thing to be done? The second? the third?

MENSURATION.

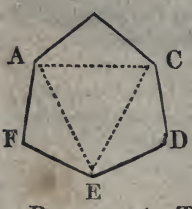
A *superficies*, or *surface*, is that which has length and breadth, but not thickness. It is called a *plane superficies*, when the surface is even, without any curvature; that is, when it is such, that if you take any two points in the surface, and draw a straight line from one point to the other, the whole of that straight line will be in the said surface.

The *area* is the whole surface enclosed.

Note. In measuring the length of a road, the chain or measuring rod must be kept parallel with the surface of the ground, however irregular; because the traveller cannot move horizontally, but must go up and down all the hills. But in measuring land, the measuring rod must be kept parallel to the horizon, or upon an exact level. The reason for which is, that all the calculations of the quantity of land, are calculations of the areas of plane figures. And they ought in justice to be so; because, although a piece of ground which has a hill in it, has, in reality, more surface than if the hill was removed, and it was reduced to an exact level, yet nothing more can grow upon it; for the stalks of grain always shoot up in a direction perpendicular to the horizon, and not perpendicular to the surface of the soil.

A plane *triangle* is a figure bounded by three straight lines.

Every piece of ground, bounded by right lines, may be divided into triangles.



EXAMPLE.

Let ABCDEF, be an irregular field of six sides. Draw a line from A to C, from C to E, and from E to A, and it will be divided into four triangles.

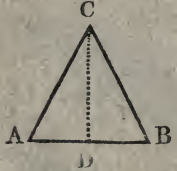
PROBLEM 1. *To find the area of a triangle.*

RULE 1. Measure one side of the triangle, and also measure the perpendicular distance from that side to the opposite angle.

2. Multiply these together, and half the product will be the same.

Note. The most convenient instrument for measuring land, is the chain. As 160 square poles make an acre, the chain is made 4 poles, or 66 feet in length; and so, 10 square chains make an acre. The chain again is divided into 100 links. And the account being kept in chains and decimals of a chain, is reduced to acres and decimals of an acre, by removing the decimal point one figure to the left.

EXAMPLE.



Let ABC be a triangular field. Let the side AB be 25 chains and 75 links, and the perpendicular CD 16 chains and 25 links. How many acres does the field contain?

Operation. $25{\cdot}75 \times 16{\cdot}25 = 418{,}4375$, and half of that, or $209{\cdot}21875$ is the area in chains; which gives $20{\cdot}921875$ for the area in acres, which is the answer.

Where a chain cannot be had, a pole may be used, $16\frac{1}{2}$ feet long, which is the length of a pole, rod, or perch. The

above field being measured by such a pole, the side AB would be 103 poles, and the perpendicular CD 65 poles. These multiplied together, make 6695; and the half of that is 3347½, which is the area in poles: which, divided by 160, the number of square poles in an acre, gives, as before, 20·921775 acres, or 20 acres, 3 roods, and 27½ poles.

Note. To find the point in the side AB, where the perpendicular from the angle C will fall: Make a cross of two pieces of wood, which shall cross each other at right angles, (thus †;) which may easily be done by the help of a common carpenter's square. Lay the cross upon the line AB, so that one of the pieces shall coincide with that line; and then move it along that line, till the other piece shall point to the angle C; and the point where the cross stands, will be the point where the perpendicular falls. It is not supposed that this method will give the point exactly, but near enough for common purposes.

Where a perpendicular cannot be conveniently measured, work by

RULE 2.

1. Measure all the sides of the triangle, add them together, and take half the sum.

2. Subtract the sides, one by one, from the half sum so found, and note the three remainders.

3. Multiply the half sum and the three remainders all together, and the square root of the last product will be the area.

EXAMPLE.

Let ABC be a triangle, of which the side AB is 103 poles, BC 77 poles, and CA 90 poles; what is the area?

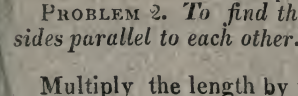
Operation. 103+77+90 is 270, half of which is 135. Next, 103 from 135 leaves 32; 90 from 135 leaves 45, and 77 from 135 leaves 58. Then, 135×32×45×58 is 11275200; the square root of which is 3357·8, for the area in poles, or 20 acres, 3 roods, and 37·8 poles.

PROBLEM 2. *To find the area of a field which has four sides parallel to each other.*

RULE.

Multiply the length by the breadth, and the product will be the area.

EXAMPLE.



Let ABCD, or EFGH, be a field of four parallel sides, to find the area.

If the angles are right angles, as in the figure ABCD, AB or CD will be the length,

and AC or BD the breadth. But if the angles are not right angles, as in the figure EFGH, measure a perpendicular from one side to the other, as EI, and this will be the breadth.

Let AB be 32 chains, and AC 14 chains; what is the area?

Operation. $32 \times 14 = 448$ chains, or 44·8 acres. *Ans.*

Again. Let EF be 32 chains, and EI 14 chains; the answer is the same.

Note If the sides are not parallel, divide the field into triangles, as before; for if you multiply the length by the breadth, you will not have the true area.

PROBLEM 3. *To find the area of a circle.*

RULE.

Square the diameter, and multiply that square by the decimal ·7854, and the product will be the area.

EXAMPLE. If a rope, 3 rods long, be tied one end to a horse's head, and the other end to a stake, how great an area of grass can he eat?

Operation. As 3 rods is the radius, or distance from the centre to the circumference, 6 rods is the diameter of the circle. This squared is 36; and that multiplied by ·7854, is 28·2744 rods or poles, the area of the circle.

PROBLEM 4. *To find the diameter, or the circumference, one from the other.*

RULE. As 113 is to 355, so is the diameter to the circumference.

EXAMPLE. What is the circumference of a circle, whose diameter is 315 rods?

Operation. 113 : 355 :: 315 : 989·6+ *Ans.*

PROBLEM 5. *To find the relative proportion of similar figures.*

RULE. The areas of similar figures are to each other as the squares of their similar dimensions.

EXAMPLE. If a rope 3 rods long allow a horse to graze 28·2744 rods of ground, how long must a rope be to allow him to graze an acre?

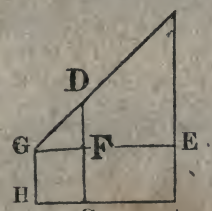
Operation. 28·2744 : 9 :: 160 : 50·9·94. That is, as the first area is to the square of the length of the rope, or radius of the circle, so is the second area, to the square of its radius; which being found to be 50·9·94, its square root is 7·13+ rods, which is the length of the rope required.

PROBLEM 6. *To measure the height of a tree, or other object.*

RULE. Set up a pole perpendicularly, the length of which above the ground is known. Go to the foot of the tree, and make a mark in it at the height of your eye from the ground,

and make a mark in the pole at the same height. Then go backward till you find such a station that your eye shall be exactly in a range with the top of the pole and the top of the tree, and also in a range with the marks in the pole and in the tree. Measure the distance from that station to the foot of the pole, and also to the foot of the tree. And then say, as the distance from your station to the foot of the pole, is to the height of the pole above the mark; so is the distance from your station to the foot of the tree, to the height of the tree above the mark. Then, add to the height so found, the distance from the mark to the ground, and the sum will be the true height of the tree.

EXAMPLE.



Let AB be a tree, the height of which is to be measured. Let CD be an upright pole, 15 feet above ground. Let E be the mark in the tree for the height of your eye, which suppose to be 5 feet; and F the mark in the pole, of the same height. Then, FD, the part of the pole above the mark, will be 10 feet. Let G be the place of your eye, which is in a range with D and B, the top of the pole and the top of the tree; and let H be the station, or place where you stand. Let the distance from H to C measure 15 feet, and from H to A 45 feet. Then,

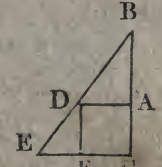
HC : FD :: HA : EB, that is,

15 : 10 :: 45 : 30, which is the height of the tree above the mark; and 30+5 is 35 feet, the true height of the tree.

Note. If the tree is not perpendicular, but leans, let the pole be placed parallel to it, and the same process will give its length.

PROBLEM 7. *To measure the breadth of a river.*

RULE.



Take any station, A, on one side; and select any object, B, on the other side, opposite to A. Measure back any distance, to C, in a range with BA, and note the distance. At any distance from A, take a point D, and also such a point, E, as shall be in a range with BD, and so that EC shall be parallel to DA. From D, make DF parallel to AC, and it will be of the same length; and measure EF and DA. Then say, EF : FD :: DA : AB, which is the breadth of the river required.

EXAMPLE. Let AC be 20 rods, and of course FD is 20 rods. Let EF be 12 rods, and DA 18 rods. Then,

EF : FD :: DA : AB; that is,

12 : 20 :: 18 : 30 rods; which is the breadth of the river.

DEFINITIONS. A *solid* is that which has length, breadth, and thickness.

A *cube* is a solid bounded by six equal squares.

PROBLEM 8. *To find the solid content of a load of wood.*

RULE. Multiply the length by the breadth, and that product by the height, and the last product will be the content.

Note The solid content of a stick of squared timber, the height and breadth of which do not vary from one end to the other, is found in the same manner. But if it tapers regularly throughout, it is the frustum of a pyramid; and its solid content may be found by the following

RULE. Add into one sum the areas of the two ends, and the square root of their product; and take one third of that sum for the mean area, which being multiplied by the length of the frustum, will give the solidity.

EXAMPLE. A stick of squared timber measures as follows: At the butt end, 14 inches by 12; at the small end, 10 inches by 8; and the length is 20 feet. What is the solid content?

Operation. $14\times12=168$ inches is the area of the butt end, and $8\times10=80$ inches is the area of the small end. $168\times80=13440$, and the square root of that is 115·93. And $168+80+115\cdot93$ is 363·93, of which one third is 121·31, which is the mean area in inches. This multiplied by the length, 240 inches, gives 29114·4 inches, or 16 feet, 1466·4 inches, for the solid content.

PROBLEM 9. *To find the superficial content of a right cone.*

RULE. Multiply the circumference of the base by the slant height, and to half the product add the area of the base, and it will give the superficial content.

Note The superficial content of a right pyramid, is found in the same manner, the slant height being measured on a line let down from the vertex perpendicularly upon the base of the triangle which forms one side of the pyramid.

PROBLEM 10. *To find the solid content of a right pyramid, or cone.*

RULE, Find the area of the base, and multiply that area by the perpendicular height, and one third of the product will be the solid content.

PROBLEM 11. *To find the relative proportion of similar solids.*

RULE. Similar solids are to each other as the cubes of their similar dimensions.

EXAMPLE. If a cone, the diameter of whose base is 3 feet, contains 100 solid feet, how many solid feet will a similar cone contain, the diameter of whose base is 6 feet?

Operation. The cube of 3 is 27, and the cube of 6 is 216; therefore, 27 : 216 :: 100 : 800 feet, *Ans.*

PROBLEM 12. *To find the solid content of a cylinder.*

RULE. Multiply the area of the base by the height, and the product will be the solidity.

Note. A stick of round timber, of the same diameter throughout, is a cylinder. If the stick tapers then it is the frustum of a cone; and its solid content may be found in the same manner as the solid content of the frustum of a pyramid. See note to problem 8.

PROBLEM 13. *To find the surface of a globe or sphere.*

RULE. Multiply the circumference by the diameter, and the product will be the superficial content.

PROBLEM 14. *To find the solidity of a globe or sphere.*

RULE. Multiply the surface by the diameter, and one sixth of the product will be the solid content.

PROBLEM 15. *To find the capacity of a cask of the usual form.*

RULE. Add into one sum 39 times the square of the bung diameter in inches, 24 times the square of the head diameter, and 26 times the product of those diameters; multiply that sum by the length of the cask, and that product by ·00034; and the last product divided by 9, will give the content in wine gallons, and by 11, in ale gallons.

EXAMPLE. What is the capacity of a cask, of which the head diameter is 27 inches, the bung diameter 33 inches, and the length 36 inches?

Operation.

33×33=1089, and 1089×39=42471
27×27= 729, and 729×24= 7496
33×27= 891, and 891×26=23166

83133

And 83133×36=2992788, and 2992788×·00034=1017·54792, and 1017·54792÷9=113·06088.

So, the answer is 113·06088 gallons, wine measure.

PROBLEM 16. *To find the tonnage of a ship.*

RULE. Multiply the length of the keel in feet, by the breadth of the beam, and that product by half the breadth of the beam; and divide the last product by 95; the quotient will be the number of tons.

PROBLEM 17. *To find the solid content of an irregular body.*

RULE. Put it into any cylindrical or cubical vessel, and fill the vessel with water, sand, or any other convenient substance. Then take out the body, and measure the space left empty in the vessel by its removal, according to the preceding rules.

Note. It was by the help of this rule that Archimedes discovered the cheat that was practised upon Hiero, king of Syracuse, respecting his crown. He had directed a crown of pure gold to be made; but suspected the workman had mixed alloy with it. He therefore requested Archimedes to ascertain the fact, without injuring the crown. Archimedes took a mass of pure gold, and another of alloy, each equal in weight to the crown; and putting each separately into a vessel filled with water, observed the quantity of water expelled by each; from which he ascertained their respective bulks, and the quantity of gold and alloy which were mixed in the crown.

Suppose the weight of the crown and of each mass to be 10*lbs.*; and that, on being put into water, the alloy expelled ·92*lb*, the gold, ·52*lb*., and the compound, ·64*lb*. Then, by case 3d of alligation, the proportion of gold and alloy may be found, as follows.

$$\cdot 64 \left\{ \begin{matrix} \cdot 92 \\ \cdot 52 \end{matrix} \right) \begin{matrix} \cdot 12 \text{ of alloy,} \\ \cdot 28 \text{ of gold,} \end{matrix} \left\} \begin{matrix} = \cdot 40 \text{; but there ought to be} \\ 10lb.\text{; therefore,} \end{matrix} \right.$$

$$\left. \begin{matrix} \cdot 40 : 10 :: 12 : 3lb. \text{ of alloy, and} \\ \cdot 40 : 10 :: 28 : 7lb. \text{ of gold,} \end{matrix} \right\} \textit{Ans.}$$

PROBLEM 18. *To find what weight may be raised by any power with a lever.*

RULE. As the distance between the weight and the prop, is to the distance between the prop and the power, so is the power to the weight it will balance.

EXAMPLE. If a man, weighing 150*lbs.* rest on the end of a lever 10 feet from the prop, what weight will he balance at the other end of it, 1 foot from the prop?

1 : 10 :: 150 : 1500 *lbs. Ans.*

Note. No allowance is here made for the weight of the lever, which ought to be done in order to obtain the exact answer.

PROBLEM 19. *To find what weight may be raised by any power, with the wheel and axle.*

RULE. As the diameter of the axle, is to the diameter of the wheel, so is the power to the weight it will balance.

PROBLEM 20. *To find what weight may be raised by any power, with a screw.*

RULE. As the distance between the threads of the screw, is to the circumference described by the end of the lever, so is the power to the weight.

Note. One third of the effect of this machine should be abated for friction.

PROBLEM 21. *To find what weight may be raised by any power, with a pulley.*

RULE. If the pulley is fixed, the power and the weight are equal; but if the pulley is movable, as 1 to the number of ropes, so is the power to the weight.

PROBLEM 22. *To measure any height, by the time a heavy body would fall from it to the ground.*

RULE. In the first second, it would fall 16 feet, and in the next 48, and so on, with a velocity uniformly increasing. Therefore, as 1 is to 16, so is the square of the number of seconds, to the number of feet through which the body falls.

EXAMPLE. If a bullet falls from the top of a steeple in 8 seconds of time, what is the height of the steeple?

1 : 16 :: 9 : 144 feet, *Ans.*

Question. How deep is a chasm, into which, if you drop a stone, it will be 10 seconds before you hear it strike the bottom?

Operation. Part of the time is occupied by the falling of the stone, and part by the return of the sound after the stone strikes the bottom. To ascertain which, I work by double position, as follows:

First, I suppose the depth to be 1250 feet. Then, by the above rule, 16 : 1 :: 1250 : the square of the time occupied by the stone's falling; which proportion being worked out, gives 78·125 for the square of the time; and the square root being extracted, is 8·838+ seconds, for the time of falling. This being taken from 10, the whole time, leaves 1·162+ for the sound to return. And as sound flies 1142 feet per second, I multiply 1·162— by 1142, and it gives 1327·004— feet, for the distance it returns. But it ought to be only 1250, by the supposition; consequently the first error is 77·004— too great.

Secondly, I suppose the depth to be 1260 feet, and proceed in the same manner, and find 78·75, for the square of the time of the fall; and 8·874+, its square root, is the time; which taken from 10, leaves 1·125+, for the time of the return of the sound; and this multiplied by 1142, gives 1284·75+, for the distance it returns, which ought, by the supposition, to be only 1260; so, the second error is 24·75+ too great.

Next, 1250×24·75 is 30937·5, and 1260×77·004 is 97025·04, and their difference is 66087·54, which being divided by 52·254, the difference of the errors, gives 1264·73+ feet, for the answer or depth of the chasm.

It was not thought best, in page 6, to embarrass the young learner with the method of numerating more than nine places of figures. But as the advanced scholar may wish to know how to proceed further, the method will now be given, as far as 55 places. In the table below, it will be seen, that the name of the 13th place is *billions*, of the 19th, *trillions*, of the 25th, *quadrillions*, &c. These words are formed from the word *millions*, and the Latin numeral adverbs *bis*, *ter*, *quater*, signifying *twice*, *thrice*, *four times*; so that *billions* signifies millions of millions; *trillions*, millions of millions of millions; *quadrillions*, millions of millions of millions of millions. In this manner, the table may be extended at pleasure, the names after *nonillions*, being decillions, undecillions, duodecillions, tredecillions, quatuordecillions, quindecillions, sexdecillions, &c. each name indicating an addition of six places of figures to the number of places indicated by the preceding name. Thus, as millions is the name of the 7th place, billions of the 13th, and trillions of the 19th; so nonillions is the name of the 55th, sexdecillions of the 97th, and centillions of the 601st.

55	49	43	37	31	25	19	13	7	1
nonillions.	*octillions*	*septillions*	*sextillions*	*quintillions*	*quadrillions*	*trillions*	*billions.*	*millions*	*units.*
hund. of thou. of octil.	hund. of thou. of septil.	hund. of thou. of sextil.	hund. of thou. of quintil.	hund. of thou. of quadril.	hund. of thou. of tril.	hund. of hon. of bil.	hund. of thou. of mil.	hund. of thousands.	
tens of thou. of octil.	tens of thou. of septil.	tens of thou. of sextil.	tens of thou. of quintil.	tens of thou. of quadril.	tens of thou. of tril.	tens of bil.	tens of thou. of mil.	tens of thousands.	
thousands of octil.	thousands of septil.	thousands of sextil.	thousands of quintil.	thousands of quadril.	thousands of tril.	thousands of bil.	thousands of mil.	thousands.	
hundreds of octil.	hundreds of septil.	hundreds of sextil.	hundreds of quintil.	hundreds of quadril.	hundreds of tril.	hundreds of bil.	hundreds of mil.	hundreds.	
tens of octil.	tens of septil.	tens of sextil.	tens of quintil.	tens of quadril.	tens of tril.	tens of bil.	tens of mil.	tens.	
2,	345	678,	543	267,	895	678,	941	235,	679	874,	521	943,	245	675,	678	915,	463	726

In words. Two *nonillions*, three hundred and forty-five thousand six hundred and seventy-eight *octillions*, five hundred and forty-three thousand two hundred and sixty-seven *septillions*, eight hundred and ninety-five thousand six hundred and seventy-eight *sextillions*, nine hundred and forty-one thousand two hundred and thirty five *quintillions*, six hundred and seventy-nine thousand eight hundred and seventy-four *quadrillions*, five hundred and twenty-one thousand nine hundred and forty-three *trillions*, two hundred and forty-five thousand six hundred and seventy-five *billions*, six hundred and seventy-eight thousand nine hundred and fifteen *millions*, four hundred and sixty three thousand seven hundred and twenty-six.

PART II.

Note. The questions which follow, are intended for the practice of those who are pursuing the study of Arithmetic. As soon as the learner has been sufficiently exercised in the questions in Part I. under simple addition, in the manner there directed, he should be put upon performing these; care being taken however, that he should proceed in learning the rules in Part I. as fast as he proceeds in performing the questions in this The first 600 questions go through all the rules in the book, being questions of the most simple form. The Instructor of the school should furnish himself with a Key, containing the answer to each question annexed to its number, so that when a question is performed by any scholar, he can see at once whether the answer is right If not right, the scholar should be set to work it out again, and not be told how, till he has made sufficient trial of his own skill If the school is large, and the examination of questions should be troublesome to the Instructor, Monitors may be appointed to do it; and the different parts of the Key may be put into their hands for that purpose To prevent scholars from copying their answers from each other, they should be prevented from keeping them, and be directed to show the work of each question to the Instructor or Monitor. Should the Instructor think necessary, he can direct a scholar to go over the first 600 questions a second time, before he proceeds further. The questions from No. 601, to the end, are on all the rules promiscuously, some of the most difficult being placed towards the last.

QUESTIONS.

No. 1. The Old Testament is divided in the following manner: The Pentateuch, containing five books; other historical books, 12; the Hagiographa, 5; and the Prophets, 17. How many books in all?

2. The New Testament contains, the Gospels, 4 books; Acts of the Apostles, 1; Epistles of Paul, 14; of the other Apostles, 7; and the Revelation, 1. How many in all?

3. How many books in the whole Bible?

4. In the Pentateuch, there are 187 chapters; other historical books, 249; Hagiographa, 243; Prophets, 250. How many chapters in the Old Testament?

5. The Gospels contain 89 chapters; Acts, 28; Epistles, 121; Revelation, 22. How many chapters in the New Testament?

6. How many chapters in the whole Bible?

7. In the year 1821, the number of ordained missionaries employed among the heathen, was as follows: By the Society in England for propagating the Gospel, 1; Soc. for promoting Christian knowledge, 3; Danish Mission College, 2; Moravians, 68; English Methodist Missionary Soc. 74; English

Baptist Miss. Soc. 28; London Miss. Soc. 85; Scotch Miss. Soc. 7; English Church Miss. Soc. 32; London Jews' Soc. 6; English Soc. for conversion of Negro Slaves, 6; American Board for Foreign Missions, 24; American Baptist Do. 7; United For. Miss. Soc. 7; American Methodist Miss. Soc. 1. How many in all?

8. The number of graduates at the Colleges in New-England, in the year 1810, was as follows: Harvard, 61; Yale, 54; Dartmouth, 26; Williams, 28; Brown, 20; Burlington, 17; Middlebury, 9; Bowdoin, 12. How many in all?

9. From the creation to the flood, was 1656 years; from that to the call of Abraham, 427; from that to the departure of the Israelites out of Egypt, 430; from that to the building of the temple, 479; from that to the founding of Rome, 266; from that to the birth of Christ, 748; and from that to the commencement of the Christian era, 4; and from that to the present year, 1822. How long since the creation?

10. The following sums were subscribed to the American Bible Society, in a few days after its formation, to wit: By Elias Boudinot, ten thousand dollars; John Langdon, 400; Robert Oliver, 300; Matthew Clarkson, 150; Ann Bancker, 100; and John Jay, 150. How much was subscribed by these six persons?

11. The founders of the Andover Theological Seminary had, in the year 1820, given to it as follows: Samuel Abbot, one hundred thousand dollars; William Bartlet, 90000; Mrs Norris, 30000; Moses Brown, 35000; William Philips & Son, 15000; and John Norris, 10000. How much in all?

12. The army of Bonaparte, when he invaded Russia, consisted of 250000 French, 60000 Poles, 20000 Saxons, 30000 Austrians, 36000 Bavarians, 22000 Prussians, 20000 Westphalians, 8000 Wirtembergers, 19000 subjects of the smaller German Princes, 20000 Neapolitans and Italians, 10000 Swiss, and 4000 Spanish and Portuguese. How many in all?

13. The population of the world is estimated as follows: Europe, 17987 4000; Asia, 500 millions; Africa, 98945000; North America, 22815009; South America, 15 millions. How many in all?

14. The number of nominal Christians is estimated as follows: In Europe, 175665 00; America, 98 5000; Asia, 300000; Africa, 400000. How many in all?

15. The number of Mahometans is estimated as follows: In Europe, 4000000; Asia, 57000000; Africa, 30000000. How many in all?

16. The number of Jews has been lately estimated as follows: In Poland, one million; Russia, 20000 ; Germany, 500000; Holland and Netherlands, 80000; Sweden and Denmark, 5000; France, 30000; England, 50000; Italy, 20000; Spain and Portugal, 10000; United States, 3000; Mahometan states, 4 millions; Persia, and the rest of Asia, 500000. How many in all?

17. The Jews were dispersed from the taking of Jerusalem by Titus, in the year 70, and the New Testament was published in Hebrew, by the London Society for the conversion of the Jews, in the year 1817; how long between?

18. The London Religious Tract Society, from its formation in the year 1799, in six years, issued two millions of tracts; and in their thirteenth year, issued 2 600 000: how many more did they issue that year, than in the first six years?

19. In thirteen years, they had issued 145 0000; how many of these were issued during the second six years?

20. The British and Foreign Bible Society, in the first seventeen years, had distributed, or assisted in distributing 5945583 Bibles and Testaments, of which 327016 were from their own depositories; how many were the rest?

21. The American Bible Society was formed in the year 1816, which was 12 years after the formation of the British and Foreign Bible Society, and that was 13 years after the formation of the English Baptist Missionary Society, and that was 50 years after the commencement of the Moravian missions, and that was 27 years after the commencement of the Danish mission to Tranquebar; in what years did each of these take place?

22. In its first four years, the American Bible Society had issued 74674 Bibles, and 1 40 Testaments; how many more of the former, than of the latter?

23. In the year 1819, Leander Von Ess, Roman Catholic professor of divinity at Marburg, had distributed among his Catholic brethren, 339775 copies of the New Testament, of which 106434 were during the last year; how many before that?

24. The Connecticut Bible Society distributed, in their first 4 years, 7644 Bibles, of which 2341 were in the fourth year; how many in the other three?

25. In eight years, they had distributed 18053 Bibles; how many in the second four years?

26. The first Sabbath school was established at Gloucester, England, by Robert Raikes, in the year 78[illegible]; and Robert Morrison, who received his first religious impressions at a Sabbath school, and afterwards became a missionary, finished his translation of the Bible into Chinese in the year 1819. How long between?

27. The Russian Bible Society was formed in 1813, and that was 36 years after the Emperor Alexander was born, and that was 50 years after Russia became an empire, and that was 740 years after Christianity was introduced into Russia; in what years did each of these take place?

28. In one month of the year 1819, the number of negro slaves brought into Cuba, was 1728; how many would that be in a year, at the same rate?

29. In consequence of the numbers that were brought in, the price had fallen to 450 dollars each; what would the number for a year amount to?

30. The number of slaves transported from Western Africa for 25 years, ending in 1819, was stated to be such as would average sixty thousand a year; what was the whole number in that time?

31. What would be the whole value, at the above price in Cuba?

32. In 1815, the sum received by the two London theatres, was stated at £800 sterling a night; suppose this to be continued 5 months, 25 nights in a month, what would be the amount?

33. In December, 1814, the nine Paris theatres were stated to have received £18000 sterling; if this continued 5 months, what was the amount?

34. In 1818, the London Hibernian Society supported 480 charity schools in Ireland, which averaged about 98 scholars each; how many poor children were receiving an education from this charity?

35. The same year, the London Sabbath school society for Ireland, assisted 534 schools, which averaged about 1 2 scholars each; how many poor children were receiving aid from this charity?

36. A man who depended on his daily labor to support himself and family, appropriated the earnings of one half day each month to charitable purposes, and in one year the amount was ten dollars. The militia rolls of the United States contain the names of 75828 men. If each of these should "go and do likewise," how much would be thus raised annually?

37. The Royal Mission Chapel, built by King Pomarre, in Otaheite, and dedicated in May, 1819, is stated to be 712 feet long, and 54 wide; how many square feet does it contain?

38. If 4 square feet be allowed to each person, how many persons would it accommodate?

39. The whole number of schools in Scotland in 1820, was 3556, in which were taught 176303 children; what is the average number for each school?

40. In the year 1820, the number of schools in Ireland, under the patronage of the London Hibernian Society, was 534, and the number of scholars in them 54520; how many to each school?

41. In the year 1665, Connecticut contained about 9000 inhabitants, and had 21 ministers of the gospel; how many souls to each minister?

42. In 1713, the inhabitants were 17000, and the ministers and licensed preachers 45; how many souls to each?

43. The annual expense to the inhabitants of Boston for the support of their theatre, was estimated, in 1820, at 75000 dollars; how many missionaries would that sum support among the heathen, at 500 dollars each?

44. How many would the receipts of the London theatres support, at £125 sterling each? (See No. 32.)

45. How many would the receipts of the Paris theatres support, at the same rate? (See No. 33.)

46. The New-England Tract Society was formed in the year 1814, and in seven years had published 2708000 tracts; what is the average number per year?

47. In the western part of Virginia, there was stated to be, in 1821, a district containing 175000 souls, and only 8 educated ministers of the gospel; how many souls to each minister?

48. The population of London, in 1811, was 1039000, and it is estimated that there are 212000 strangers constantly there; how many in all?

49. If half these attend public worship, how many churches are necessary, each accommodating 800 persons?

50. In 1816, there were the following places of religious worship in London: Episcopal, 166; Dissenters, 136; Dutch and German, 19; Catholic, 13; Jews, 6; Quakers, 6. How many in all?

51. How many more were needed?

52. By official returns, it appeared, in 1820, that there were, in England and Wales, 37382 schools, and 1571372 children taught in them; what is the average number to a school?

53. At the same time, in France, 1075500 children were learning to read and write, under the care of 28000 masters; how many scholars is that for each master?

54. The following were the receipts of the principal religious charitable societies in England, in the year 1820, to wit: B. & F. Bible Society, £89154 sterling; Christian Knowledge Soc. £53100; Church Miss. Soc. £31200; London Miss. Soc. £26174; Methodist Miss. Soc. £22500; Baptist Miss. Soc. £13200; Soc. for propagating the Gospel, £13000; Soc. for conversion of Jews, £10780; National Soc. for Education, £8000; Religious Tract Soc. £7561; Hibernian Soc. £7049; Moravian Missions, £5000; Naval and Military Bible Soc. £2348; Br. & For. School Soc. £2034; Prayer Book and Homily Soc. £1993. How much in all?

55. The first missionaries landed at Otaheite in the year 1797, and idolatry was abolished in 1815; how long between?

56. The missionaries sailed for the Sandwich Islands in the year 1819, which was 2 years after the establishment of the Cherokee Mission, and that was 5 years after the first missionaries sailed from America to India, and that was 2 years after the American Board for Foreign Missions was formed, and that was 2 years after the Theological Seminary was established at Andover; in what year did each of these take place?

57. It is computed, that in the year 1813, at least 800000 men died in war, and 200000 more were maimed for life, and rendered useless; and it is reckoned that the pecuniary loss to the public, from the death of an able bodied man, is 1500 dollars; if so, what is the whole loss, in this way, of that one year?

58. It is computed that the United States lost 17000 men in the late war with Great Britain; what is the amount of that loss, on the same principle?

59. The English Sabbath School Union, in the year 1820, had, in the schools connected with it, 237384 scholars; that of Scotland, 34000; and that of Ireland, 84174. How many in all?

60. The Inquisition was established in Spain in the year 1481, and abolished in 1808; how many years did it exist there?

61. During that time, 32382 persons were burnt alive by its order; what is the average per year?

62. During the same time, 291450 persons were imprisoned, and their goods confiscated, by its order; what is the average per year?

63. It is stated that the following sums were paid by the inhabitants of Charleston, in the year 1820, for the support of the poor, to wit: Orphan Asylum, $22000; Poor House, D24000; Marine Hospital, D6000; Ladies Benevolent Society, D2000. How much in all?

64. Of the above expense, the following is stated to be rendered necessary in consequence of the intemperate use of ardent spirits, to wit: Orphan Asylum, D14000; Poor House, D18000; Marine Hospital, D4000; Ladies Benevolent Society, D1000. How much are the inhabitants of Charleston annually taxed, to support drunkards and their families?

65. The first American missionaries to Jerusalem, sailed in the year 1819, which was 602 years after that city was taken by the Turks, and that was 30 years after it was retaken from the Crusaders by Saladin, and that was 88 years after it was taken by the Crusaders, and that was 463 years after it was taken by the Saracens, and that was 22 years after it was taken by the Persians, & that was 484 years after it was rebuilt by Adrian, and that was 60 years after it was destroyed by Titus; in what year did each of these take place?

66. The number of Lancasterian schools in France in the year 1820, was 1340, containing 154000 children; how many is that for each school?

67. The number of students, professors of religion, and charity scholars, at 12 of the Colleges, in the year 1821, was stated as follows:

	Stud.	*prof.*	*ch. sch.*		*Stud.*	*prof.*	*ch.sch.*
Yale,	316	97	46	Princeton,	116	25	11
Harvard,	291	17	15	Bowdoin,	101	23	7
Union,	255	66	32	Middlebury,	100	48	22
Brown,	151	59	18	Hamilton,	92	48	34
Dartmouth,	146	65	43	Williams,	83	42	24
N. Carolina,	135	10	0	Burlington,	35	9	1

How many students, how many professors of religion, and how many charity scholars, are in these 12 colleges?

68. In the year 1819, the London Religious Tract Society issued 5626674 tracts, which was 1583353 more than they had issued the preceding year; how many were issued in 1818?

69. In 1820, the number of graduates at several of the colleges, was as follows: Union 65, Harvard 56, Yale 54, Brown 29, Dartmouth 24, Middlebury 22, Pennsylvania 17, Hamilton 14, Bowdoin 11, Burlington 9; how many in all?

70. In 1821, as follows: Union 67, Harvard 59, Yale 67, Brown 40, Dartmouth 17, Middlebury 23, Pennsylvania 35, Hamilton 18, Bowdoin 21, Burlington 5, Columbia 30, Princeton 40, Georgia 3; how many in all?

71. At the close of 1816, the Connecticut Miss. Soc. had sent 35795 books to the new settlements, of which 3589 had been sent in that year; how many before?

72. In 1821, the English Methodist Miss. Soc. had among the heathen 150 missionaries and assistants, with 2700 converts under their care; how many is that for each?

73. In 1819, the Baptist missionaries in India had under their care, 92 schools for heathen children near Serampore, 11 at Cutwa, 3 at Moorshedabad, and 5 at Dacca; and in these, about 10000 native children: what is the average number for each school?

74. The General Assembly of the Presbyterian Church in the United States, was formed in the year 1787, which was 144 years after the Assembly of Divines met at Westminster, and that was 83 years after Presbyterianism was established in Scotland by John Knox, and that was 26 years after the Reformation commenced in England, and that was 17 years after the Reformation was begun in Germany by Luther, and that was 157 years after the opposition to Popery was made in England by Wickliffe, & that was 754 years after the Pope was acknowledged Universal Bishop by the Emperor Phocas, and that was 10 years after Christianity was introduced into England by Augustin, and that was 164 years after St. Patrick began to preach in Ireland, and that was 119 years after Christianity was established in the Roman Empire by Constantine; in what year did each of these take place?

75. The property belonging to the Choctaw mission at Elliot, in Dec. 1820, was valued as follows: Sixty acres of improvements, D900; a horse mill, D200; shops, tools, and stock, D600; twenty-two other buildings, D3000; farming utensils, D400; seven horses, D420; two yoke of oxen, D160; two hundred and twenty neat cattle, D1760; sixty swine, D150; provisions, D1758; groceries, L360; household furniture, D500; cloth, D250; library, D320; boat, D400; fifty thousand brick, D300. What is the whole value?

76. The Danish mission to Tranquebar, state, in the year 1736, that in 29 years, they had received into their churches 3239 converts from heathenism; what was the average per year?

77. In 24 years afterwards, the number of converts added was 8267; what was the average per year?

78. In 1813, the Moravians had 31 missionary stations, as follows: South Africa, 2; S. America, 4; N. America, 7; Greenland, 3; and the rest in the West Indies; how many were the last?

79. At the same time, they had 157 missionaries and assistants at their stations; what is the average to each station?

80. In 1817, the number of converted negroes under the care of the Methodist missionaries in the West Indies, was stated as follows: In Antigua, 3552; St. Christophers, 2552; St. Eustatius, 313; St. Vincents, 2760; Bahamas, 584; St. Barts, 447; Bermuda, 62; Dominica, 638; Grenada, 171; Nevis, 1183; Trinidad, 267; Tortola and Virgin Islands, 1664; Jamaica, 4126; Barbadoes, 44: Tobago, 140. How many in all?

81. These were under the care of 38 missionaries and assistants; what is the average to each?

82. The number baptized by the Baptist missionaries in India in the year 1814, was 129; and the whole number from the commencement of their mission, 765; how many before that year?

83. The number of ordained missionaries among the heathen in the year 1821, was 351, in the following countries, to wit: Africa, 45; Isle of France, 2; Malta, 3; Ionian Islands, 1; Polish Jews, 5; Turkey in Europe, 1; Turkey in Asia, 3; Russia in Asia, 17; China, 1; India beyond the Ganges, 10; India within the Ganges, 78; Ceylon, 26; Indian Archipelago, 7: Australasia, 2; Polynesia, 17; Spanish and Portuguese America, 14; Blacks of the West Indies, 66; Indians in the United States, 23; Labrador, 19; and the rest in Greenland; how many were the last?

84. If 50000 missionaries should be sent to the heathen, and 12000 heathen should be allotted to each missionary, how many of them would be supplied at that rate?

85. It is estimated that the annual income of the people of the United States, is three hundred millions of dollars; if one tenth of this should be devoted to the support of missionaries, how many would it furnish, at 500 dollars each?

86. In 1821, Dr. Carey and his associates had translated and printed the whole Bible in five of the languages of the East, the New Testament in ten more, and parts of the latter in sixteen more; this was 26 years after they began the work, and that was 84 years after the Tamul Testament was published by Ziegenbalg, and that was 26 years after Elliot's Indian Bible was printed in America, and that was 72 years after the present English version was published by King James, and that was 74 years after the first English edition of the Bible was authorised by Henry the eighth, and that was 13 years after the first English Testament was published by Tyndal, and that was 4 years after Luther published his Testament in German, and that was 78 years after the first books were printed from metallic types by Faust and others, and that was 14 years after printing with wooden types was invented by Laurentius in Holland, and that was 70 years after Wickliffe translated the Bible into English; in what year did each of these take place?

87. In 1820, the number of Christian pilgrims to Jerusalem was as follows: Greeks, 1600; Armenians, 1300; Copts, 150; Roman Catholics, 50; Abyssinians, 1; Syrians, 30. How many in all?

88. In 1810, the English Soc. for promoting Christian Knowledge, distributed 10224 bibles, 16242 testaments and psalters, 20555 prayer books, 20908 other bound books, and 145123 tracts; how many in all?

89. In 1814, as follows: 26766 bibles, 48018 testaments and psalters, 65492 prayer books, 51525 other bound books, and 6 3501 tracts; how many in all?

90. How many more in the last year, than in the other?

91. The American Bible Soc. in 1820, (their 5th year,) issued 29000 bibles, and 30000 testaments; and the total of copies of the whole bible, or parts of it, issued by them, was 23 552; how many in the first four years?

92. The *Hegira*, or flight of Mahomet from Mecca to Medina, was in the year 622; and Constantinople was taken by the Turks in 1453; in what year of the *Hegira* was it?

93. The New-England Tract Society was established in 1813, and in 1821 had published 2708000 tracts; how many is that for each year?

94. In 1810, the Maine Miss. Soc. received 1081 dollars and 38 cents; how many mills is that?

95. In 1818, the receipts of the English Christian Knowledge Soc. were £13923 .. 9 .. 5; how many farthings is that?

96. In 1815, the amonnt was £50226 .. 10 .. 1; how many pence is that?

97. In 1817, the amount was 56885012 farthings; how many pounds is that?

98. In 1819, the receipts of the London Jews Soc. were 10752960 farthings; how many pounds is that?

99. How many grains in 367 lbs. Troy?

100. How many drams in 3 tons?

101. How many grains in 45 lbs. Apothecaries' wt.?

102. In 50 miles, how many barley corns?

103. How many lbs. Apothecaries' wt. in 13337791 grains?

104. In 356 yds. how many nails?

105. In 18 lbs. how many scruples?

106. In 64960 lbs. how many tons?

107. In 4160 poles, how many acres?

108. How many pints in 21 hhds. wine measure?

109. In 4976 pints, how many bushels?

110. In 2279772 barley corns, how many miles?

111. How many yds. in 1052 nails?

112. How many tons in 20563712 drams?

113. In 25401600 seconds, how many weeks?

114. In 5 hhds. wine measure, how many gills?

115. How many poles in 456 acres?

116. In 213096 grains, how many lbs. Troy?

117. How many pints in 786 bushels?

118. In 365 days, how many seconds?

119. In 14 tons, how many lbs.?

120. How many miles in 34665840 inches?

121. In 319 nails, how many yds,?

122. How many ounces in 5 tons?

123. How many lbs. Troy in 245678 grains?

124. The expenditures of the Charitable Soc. of Hillsborough County, N. H. for the year 1818, were as as follows: For bibles, D296·77; domestic missions, D34·20; foreign missions, D126·86; education of pious youth, D209·34: how much in all?

125. The General Committee of the Moravians, received for their several missions, in 1818, as follows: Collections from congregations and friends, £1545 .. 2 .. 10 sterling; benefactions, chiefly in England & Scotland, £4035 .. 10 .. 8; legacies, £683 .. 13 .. 2; balance from West Indies, £240 .. 0 .. 5; gained by exchange, £6 .. 17 .. 6: how much in all?

126. Their payments for missions were as follows:— Greenland, *L*712 .. 10 .. 7; Labrador, (besides what was supplied from other sources,) £105 .. 5 .. 11; N. American Indians, £218 .. 4 .. 4; W. Indies, *L*2881 .. 9 .. 2; South America, £190 .. 10 .. 11; S. Africa, *L*1124 .. 12 .. 2: how much in all?

127. Their other expenses were as follows: Pensions to superannuated missionaries, £748 .. 11 .. 2; widows of missionaries, £317 .. 10 .. 3; education of sixty-three children of missionaries, *L*853 .. 15 .. 7; sundries, *L*787 .. 14: how much in all?

128. What was the whole amount of expenditure for that year?

129. In the year 1820, there was raised in the county of Otsego, N. Y. 125 bushels, 4 quarts of corn, on one acre; 120 bush. 2 pecks, on another; 118 bush. 4 qts. on another; 117 bush. on another; 111 bush. on another; 95 bush. 4 qts. on another; and 90 bush. 2 pecks, 6 qts. on another: how much on seven acres?

130. One piece of cloth contains 37 yd. 3 qr. 3 na.; another, 28 yd. 2 na.; another, 39 yd. 2 qr.; another, 9 yd. 3 na.: how much in all?

131. Bought of A, 76 acres, 3 roods, 27 poles; of B, 26 acres, 37 poles; of C, 19 acres, 3 roods; of D, 11 acres, 2 roods, 17 poles: how much in all?

132. Journeyed on different days as follows: 36 miles, 3 furlongs, 21 poles; 21 miles, 37 poles; 34 miles, 7 furlongs, 28 poles; 56 miles, 6 furlongs; 47 miles, 27 poles: how far in all?

133. Sold A, 3 Cwt. 2 qr. 27 lb. of flour; B, 4 Cwt. 3 qr. 19 lb.; C, 5 Cwt. 2 qr. 19 lb.; D, 4 Cwt. 21 lb.; E, 9 Cwt. 3 qr. 18 lb.: how much in all?

134. In 1820, the American Bible Soc. received D49578·34, and expended D47759·60; what is the difference?

135. The American Board for Foreign Missions received D39334·51, and expended D57420·93; how great was the deficiency?

136. The United Foreign Mission Soc. received D15263·35, and expended D14010; what sum remained unexpended?

137. The receipts of the American Education Soc. for 1819, were D19330; for 1820, D15148·80; how great was the falling off?

138. In 1821, its receipts were D13108·97 and its expenditures D10018·72; what is the difference?

139. In 1819, the British and Foreign Bible Soc. received *L*93033 .. 6 .. 7 sterling, and expended *L*123647 .. 12 .. 3; what was the excess of expenditure?

140. The Church Missionary received *L*80000 sterling, and the London Miss. Soc. *L*25406 .. 16 .. 4; what is the difference?

141. In 1820, the London Missionary Society received *L*26174 .. 4 .. 3 sterling, and expended *L*27790 .. 17 .. 1; what was the excess of expenditure?

142. The L ondon Jews Soc. received *L*10789 .. 18 .. 2 sterling, and expended *L*13137 .. 16 .. 1; what was the excess of expenditure?

143. Bought 2 tuns of wine, and sold 3 hhds. 25 gals. 1 qt.; how much is left?

144. Bought 642 lb. 9 oz. 8 gr. of silver, and sold 537 lb. 6 oz. 10 dwt.; how much is left?

145. Borrowed 46 Cwt. 3 qr. 16 lb. of hay, and returned 10 Cwt. 1 qr. 26 lb.; how much remains to be returned?

146. From 6 lb. 9 oz. 1 sc. 19 gr. of medicine, take 5 lb. 11 oz. 7 dr. 10 gr.; how much is left?

147. If a man earns 1 doll. 12½ cents a day, and should devote to the Lord the earnings of one day every month, what would be the amount in a year?

148. If the fees of a physician average D3·25 every week day, and he should be under the necessity of attending patients on the Sabbath to half that amount, and should devote the proceeds of all his Sabbaths to Him who is Lord of the Sabbath; what would be the yearly amount?

149. If a journeyman mechanic can earn 9 cents an hour, and perform his day's work in 9 hours, how much can he earn in a year for doing good, by working one hour extra each day, there being 313 working days in a year?

150. If an apprentice can earn 6 cents an hour, how much can he earn in a year for doing good, by the same method?

151. If a young woman can earn with her needle, 4 cents an hour, how much can she earn in a year for doing good, by the same method?

152. If a little girl can earn by knitting, 5 mills an hour, how much can she earn in a year for doing good, by the same method?

153. If a little boy should raise 12 chickens in a year, which, when full grown, should weigh 2 lb. 8 oz. each, and should sell them for 5 cents a lb. and devote the avails to the

education of heathen children, what would be the annual amount?

154. If a man drinks half a gill of ardent spirits every day, how much is that in a year?

155. If he makes use of half a pint every day for himself and friends, how much is that in a year?

156. How much is it in 20 years, allowing 5 leap years?

157. What cost 119 cords of wood, at D2·67 a cord?

158. What cost 12 lb. of tea, at 7s. 6d. a lb.?

159. What cost 96 bushels of rye, at 6s. 9d. a bushel?

160. What cost 11 Cwt. of flour, at £1 .. 4 .. 6 per Cwt.?

161. Sold to 19 persons, each, 17 Cwt. 3 qr. 21 lb. 14 oz. 15 dr.; how much in all?

162. Bought of 25 persons, each, 9 lb. 10 oz. 17 dwt. 21 gr. of silver; how much in all?

163. Mixed 16 sorts of medicine, of each 2 lb. 3 oz. 5 dr. 1 sc. 18 gr.; what is the weight of the whole mass?

164. Sold to 24 persons, each, 8 quarters, 7 bush. 3 pks. 1 gal. 3 qt. 1 pt. of wheat; how much in all?

165. Bought 13 parcels of wood, each 13 cords, 127 ft. 1727 inches; how much in all?

166. Bought 44 pieces of land, each 16 A. 3 R. 36 p.; how much in all?

167. Sold 35 pieces of cloth, each 25 yd. 3 qr. 3 na.; how much in all?

168. If 168 yds. cost £40 .. 12, what is that per yd.?

169. If 35 proprietors bought a tract of 40000 acres, what is the share of each?

170. If 13 persons joined in purchasing 3 hhds. of wine, what is the share of each?

171. If 236 lb. 10 oz. 6 dr. 2 sc. 18 gr. of medicine be made up into 16 equal parcels, what weight will be in each?

172. If 25 persons were joint purchasers of 35 Cwt. 3 qr. 21 lb. of sugar, what is the share of each?

173. In the year 1819, the receipts of the American Education Soc. were D19330, and the number of young men assisted was 161; how much would that average to each, if the whole had been distributed?

174. In 1820, the receipts of the Western Education Soc. were D1755·61, and the expenditures D1601·62; what is the difference?

175. They had 36 young men under their care; what would the amount expended be for each?

176. The receipts of the Baptist Missionary Soc. of Mas-

sachusetts, were D2575·68; how many weeks missionary labor would it pay for, at D8 a week?

177. In the year 1802, there were 11 societies in the U. States for the support of missions in our own country, and their receipts were D1010; what was the average for each?

178. In 1810, the year the American Board for Foreign Missions was formed, the receipts of the same societies were D10721; what was the average for each?

179. In 1818, the receipts of these same societies were D23675; what was the average for each?

180. What was the average yearly increase of each society for the 8 years before the Board was formed?

181. What, for the 8 years after the Board was formed?

182. In 1821, the American Education Soc. had under its care 250 beneficiaries, and distributed among them D9093; what is the average for each?

183. The donations to the Massachusetts Miss. Soc. for 1818, were *L*356..0..11, N. Eng. currency; if that sum paid for 196 weeks missionary labor, how much would it be per week?

184. In 1820, there was received for the aid of charity students at the Theological Seminary at Princeton, D2855·40½, and the number of students was 76. If one half of these received aid, how much would it be for each?

185. In 1815, the number of Hottentots belonging to the settlement at Bethelsdorp, was about 1200. The same year they paid in taxes to government, D3500; contributed for missions, D332·80; collected for their own poor, D177; and were building a school room, and printing office, 70 feet by 80, estimated to cost at least D614·20; what does the whole amount average for each individual?

186. The number of missionaries and assistants employed by the American Board in 1820, was 88, and they had 3000 heathen children under instruction; what is the average for each?

187. The disbursements for the several missionary stations were D48565; how much is that for each missionary and his scholars?

188. The Rev. Joseph Emerson received for his astronomical lectures in Boston, in 1819, D643, and his expenses were D117. If the remainder was divided among 14 young ladies, to assist in qualifying them for instructing schools, how much would it be for each?

189. In 1820, it was estimated that there were in New-England, 250000 young men, between 15 and 35 years of age. If 70000 of these give 25 cents each per annum; 100000, 75 cents each; 50000, D2 each; 20000, D5 each; and 10000, D10 each, to the American Education Soc., what will be the annual amount?

190. How many young men would that assist in preparing for the ministry, at D125 each per annum?

191. What is the greatest common measure of 82 & 124?

192. What is the greatest common measure of 164 & 248?

193. What is the least common multiple of 3, 4, and 5?

194. Of 4, 5, 6, and 7?

195. Of 2, 3, 5, and 12?

196. Reduce $\frac{144}{240}$ to its lowest terms.

197. Reduce $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{3}{5}$, to a common denominator.

198. Reduce $12\frac{7}{9}$ to an improper fraction.

199. Reduce $\frac{15}{7}$ to a mixed number.

200. Reduce $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ to a single fraction.

201. Reduce $\frac{5}{6}$ of a penny to the fraction of a pound.

202. Reduce $\frac{2}{7}$ of a Cwt. to the fraction of a lb.

203. Reduce $\frac{3}{6}$ of a *L.* to its value.

204. Reduce $2\frac{3}{4}$d. to the fraction of a shilling.

205. Add $\frac{3}{5}$ and $\frac{4}{5}$.

206. Add $\frac{3}{5}$ and $\frac{5}{6}$.

207. Add $\frac{3}{5}$ of a shilling, and $\frac{4}{15}$ of a penny.

208. From $\frac{3}{4}$, take $\frac{5}{7}$.

209. Take $\frac{5}{12}$ from $\frac{3}{4}$.

210. Tell the product of $\frac{3}{4}$ by $\frac{2}{3}$.

211. Of $\frac{2}{7}$ by $\frac{5}{8}$.

212. Divide $\frac{25}{9}$ by $\frac{5}{3}$.

213. Divide $\frac{5}{9}$ by $\frac{2}{15}$.

214. Tell the sum of 29·0146+3146·5+2109+·62417+14·16.

215. Tell the difference between 91·73, and 2·138.

216. Tell the product of 79·347 by 23·15.

217. Of 51·3 by 1000.

218. Tell the quotient of 27 by ·2685.

219. Of 27·3 by 100.

220. Reduce $\frac{7}{24}$ to a decimal.

221. Reduce 9d. to the decimal of a *L.*

222. Reduce 1 dwt. to the decimal of a *L.*

223. Reduce 15s. $9\frac{3}{4}$d. to the decimal of a *L.*

224. Tell the value of ·625 of a shilling.

225. Of ·8635 of a *L.*

226. Of ·625 of a Cwt.

227. If 4 yds cost 12s., what cost 8 yds.?

228. If 7 yds. cost 15s., what cost 9 yds.?

229. If 36 men can build a wall in 24 days, how many men can do it in 9 days?

230. If 6 Cwt. 2 qr. of sugar cost *L*18 .. 16 .. 4, what cost 3 Cwt. 1 qr. 27lb.?

231. If 18 yds. cost 10s., what cost 31 yds.?

232. If 50 men can perform a piece of work in 12 days, how many can do it in 4 days?

233. What will 12 yds. of lace cost, at the rate of *L*56 for 96 yds.?

234. If, when the price of wheat is 9s. 6d. a bushel, the penny loaf weighs 8 oz., what must it weigh when the price of wheat is 16s. a bushel?

235. How many men must be employed 12 days, to perform the work which 4 men can do in 48 days?

236. If 18 yds. cost 9s., what cost 21 yds.?

237. A lent B 750 dollars for 8 months; how long must B lend A 500 dollars to be equivalent?

238. How many yds. can be bought for *L*14 .. 8, when 16 yds. cost 12s.?

239. A goldsmith bought 14 lb. 3 oz. 8 dwt. of gold, for 2035 dollars, what is that per ounce?

240 If a staff — feet high, casts a shade, on level ground, 5 feet long, how high is that steeple, the shade of which, at the same time, measures 215 feet?

241. In how many days can 12 men perform a piece of work, which 18 men can do in 60 days?

242. In 1818, the number in the Moravian societies was stated to be 26000, and that they then had 170 missionaries & assistants among the heathen. If the rest of the nominally Christian world did as well as the Moravians, how many missionaries would now be in the field? (See No. 14.)

243. How many of those destitute of the gospel, would fall to the lot of each missionary? (See Nos. 13 and 14.)

244 If the whole number of Protestants is 60 millions, and they had all done as well as the Moravians, how many missionaries would they have in the field?

245. How many would fall to the lot of each missionary, in that case?

246. The Moravians reckoned their converts from heathenism to be 60200; if the rest of the Protestant world had

done as well, what would have been the whole number of converts?

247. The Baptist mission at Serampore, was begun in 1794; and in 1818, they had 50 native preachers, and 20 churches of converted natives; of which, that at Chittagong was estimated at 150 members; that at Jessore, 95; that at Dinagepore, 105; that at Serampore and Calcutta, 190: how many in these four?

248. If the other 16 contained half as many in proportion, what would be the whole number?

249. The number of slaves imported into Havana from Africa, from Dec. 1, 1816, to July 31, 1817, was 11161; how many would that be in a year, at the same rate?

250. If 4 men, in 12 days, can reap 36 acres of wheat, how many acres can 6 men reap in 18 days?

251. If 6 men can reap 72 acres in 12 days, how many men can reap 96 acres in 6 days?

252. If the wages of 6 men for 42 weeks be 60 dollars, what will be the wages of 14 men 52 weeks?

253. If 40 shillings be the hire of 8 men for 4 days, how many days must 30 men work for £20?

254. If 12 oxen eat 24 acres of grass in 15 days, how many acres will serve 24 oxen 45 days?

255. If the interest of 350 dollars for 8 months is 18 dollars, what sum in a year will gain 6 dollars?

256. If 100 dollars in a year gain 6 dollars, what will 525 dollars gain in 254 days?

257. If £100 gain £6 in 12 months, what sum will gain £36 in 6 months?

258. An auxiliary missionary society, composed of 100 slaves, at Berbice, S. America, raised, in 8 months, £35 sterling; what would that be for each member per annum?

259. If $\frac{3}{8}$ of a yd. cost $\frac{2}{5}$ of a £., what cost $\frac{5}{16}$ of a yd.?

260. If $\frac{3}{16}$ of a ship is worth £273 .. 2 .. 6, what is $\frac{5}{22}$ of it worth?

261. If the penny loaf weighs $6\frac{9}{10}$oz. when wheat is 5s. a bushel, what ought it to weigh when wheat is 8s. 6d. a bush.?

262. If 3 men, in 6 days, spend £$10\frac{1}{2}$, what will 20 men spend in 30 days?

263. If 1·5 oz. of silver costs 7·8s., what cost 29·1 lb.?

264. What cost 3·4 lb. at £4·5 for 1·47 Cwt.?

265. If the wages of 4 men for 24·6 days, be £18·9, what will be the wages of 8 men for 16·4 days?

	Find the cost of			Find the cost of	
266.	7612 lb. at	$\frac{1}{2}$d.	278.	121 lb. at	4s.
267.	6812	$\frac{1}{4}$d.	279.	471	5s.
268.	4712	$\frac{3}{4}$d.	280.	191	6s.
269.	15344	$\frac{1}{2}$d.	281.	242	8s.
270.	7672	$\frac{1}{4}$d.	282.	345	6s. 8d.
271.	9424	1d.	283.	678	13s. 4d.
272.	8612	$1\frac{1}{2}$d.	284.	567	13s. 2d.
273.	1218	$2\frac{1}{4}$d.	285.	825	£3 .. 6 .. 8
274.	8612	$1\frac{3}{4}$d.	286.	676	14 .. 17 .. $9\frac{1}{2}$
275.	7812	$3\frac{1}{2}$d.	287.	346	12 .. 19 .. $11\frac{1}{2}$
276.	1218	8d.	288.	488	14 .. 8 .. 6
277.	6002	$11\frac{1}{2}$d.			

289. Find the cost of 27lb. 10oz. Troy, at £1 .. 6 .. 8 per lb.

290. Of 13 lb. 10 oz. 12 dwt. 8 gr. at £2 .. 3 .. 4 per lb.

291. Of 476 A. 3 R. 28 p. at £4 .. 12 .. 8 per acre.

292. Of 957 A. 3 R. 16 p. at £3 .. 7 .. 11 per acre.

293. Find the neat weight of 856 Cwt. 1 qr. 19 lb. of tobacco, tare in the whole, 17 Cwt. 2 qr. 13 lb.

294. Find the neat weight of 13 hhds. of tobacco, each weighing 6 Cwt. 2 qr. 27 lb. gross; tare in the whole, 9 Cwt. 3 qr. 17. lb.

295. Find the neat weight of 6 casks of sugar, weighing, gross, 4 Cwt. 3 qr. 12 lb. each; tare 18 lb. each.

296. What do they come to, at £3 .. 4 .. 7 per Cwt.?

297. Find the neat weight of 12 casks of raisins, each weighing 3 Cwt. 3 qr. 16 lb. gross; tare, 20 lb. per cask.

298 What is the value, at £2 .. 14 .. 6 per Cwt.?

299. Find the neat weight of 50 kegs of figs, gross 86 Cwt. 3 qr. 14 lb., tare 14 lb. per Cwt.

300. What do they come to, at 19s. 8d. per Cwt.?

301. In 28 bags of coffee, each 3 Cwt. 3 qr. 12 lb. gross, tare 14 lb. per Cwt., trett 4 lb. per 104 lb., how much neat?

302. Find the value, at £3 .. 18 .. 9 per Cwt.

303. In 9 Cwt. 3 qr. 27 lb. gross, tare 38 lb., trett 4 lb. per 104 lb., how many lb. neat?

304. Find the value at $8\frac{1}{4}$d. per lb.

305. Tell the interest of £157 for 1 year, at 6 per cent.

306. Of £234, at 4 per cent.

307. Of £5678, at 7 per cent?

308. Of $234, at $7\frac{3}{4}$ per cent.

309. Of $158, at 8 per cent.

310. Of $789, at $5\frac{1}{2}$ per cent.

311. Of £2340, for 9 months, at $6\frac{1}{2}$ per cent.

312. Of £600 for 8 months, at $5\frac{1}{2}$ per cent.
313. Of £6740 for 7 months, at $6\frac{1}{4}$ per cent.
314. Of £56 .. 12 .. 8 for $1\frac{1}{2}$ years, at 5 per cent.
315. Of £65 .. 19 .. 6 for 5 years, at 6 per cent.
316. Of £66 .. 10 .. 6 for 5 years, at $6\frac{1}{2}$ per cent.
317. Tell the amount of $624·25, for 130 days, at 6 per ct.
318. Of $786·30, for 255 days, at $6\frac{1}{2}$ per cent.
319. Of $687·34, for 320 days, at 7 per cent.
320. Of £628 .. 13 .. $8\frac{3}{4}$, for 5 y. $11\frac{1}{2}$ mo. at 6 per cent.
321. What is the insurance of an East India ship and cargo, valued at £8406 .. 18 .. 6, at $1\frac{1}{2}$ per cent.
322. What principal, at interest for 8 years at 5 per cent, will amount to £720?
323. At what rate per cent will £600 amount to £924, in 9 years?
324. In what time will £700 amount to £940, at 5 per ct.?
325. A merchant has sold goods on commission, to the amount of $345600; what is his commission, at $2\frac{1}{2}$ per ct.?
326. What sum at interest for 9 years and 6 months, at 7 per cent, will amount to $1456·87\frac{1}{2}$?
327. If $2\frac{1}{2}$ per cent is allowed for commission, what must be paid on £1234 .. 17 .. 8?
328. In 1817, England agreed to pay Spain £400000 sterling, for which Spain agreed to abolish the slave trade, after May, 1820; what is the annual interest of that sum, at 6 per cent?
329. In 1818, the Connecticut school fund was $1608673·89; what would it yield annually at 6 per cent?
330. The amount distributed from the common school fund of New-York, was $140000; what must the fund have been, to yield that amount at 7 per cent?
331. The expenditures on the United States armory at Springfield, from 1795 to 1820, had been $2072676; if this had been put into a fund for religious purposes, what would it annually yield at 6 per cent?
332. How many bibles would it annually furnish for charitable distribution, at 60 cents each?
333. How many young men would it assist in obtaining an education, at $125 each?
334. How many missionaries would it support, at $500 each per annum?
335. In 1820, the permanent fund of the Connecticut Missionary Soc. was D33405·55½; what sum will it annually yield, at 6 per cent?

336. How many weeks missionary labor will it pay for every year, at 8 dollars a week?

337. In 1820, the amount of interest received by the American Board for Foreign Missions, was D2154·60; what must have been the principal of their permaneat fund, to yield that amount, at 6 per cent?

338. What is the amount of *L*720, for 4 years, at 5 per cent, compound interest?

339. What is the amount of *L*50, in 5 years, at 5 per cent, compound interest?

340. What is the compound interest of *L*370, for 6 years, at 4 per cent?

341. What is the compound interest of *L*450, for 7 years, at 5 per cent?

342. Tell the present worth of *L*80 .. 15, for 19 months, discount at 5 per cent.

343. Tell the discount of *L*1591 .. 2 .. 4, for 11 months, at 6 per cent.

344. Sold goods for *L*397 .. 15 .. 7, to be paid in 4 months; what is the present worth, at $3\frac{1}{2}$ per cent?

345. A owes B *L*2468, of which *L*1234 is payable in 6 months, and the rest in 10 months; but they agree to reduce them to one payment; when must that be?

346. A merchant has owing to him *L*1000, of which *L*150 is due now, *L*150 in 2 months, *L*200 in 4 months, and the rest in 6 months; what is the equated time?

347. C owes D *L*480, payable 5 months hence; but is willing to pay *L*80 now, if D will wait longer for the rest; to what time must he wait?

348. What quantity of tea, at 20s. per lb. must be given in barter for 1 Cwt. of chocolate, at 4s. per lb?

349. How much flour, at 56s. per Cwt. must be given for 7 Cwt. of raisins, at 5d. per lb.?

350. A has 24 sheep, at 16s. 8d. each, for which B is to pay *L*12 in cash, and the rest in potatoes, at 2s. a bushel; how many bushels of potatoes must A receive?

351. B delivered 6 hhds. of molasses, at 6s. 8d. a gallon, to C, for 252 yds. of cloth; what was the cloth per yard?

352. How much coffee, at 25 cents per lb. can I have for 56 lb. of tea, at 80 cents per lb.?

353. A delivered to B 980 bushels of corn, at 50 cents a bushel, and received 55 Cwt. 2 qr. of cheese, at 4 dollars per Cwt.; how much money must A receive in addition, to pa for his corn?

354. How much wine, at D1·28 per gal. must I have for 13 Cwt. 1 qr. 7 lb. of raisins, at D9·444 per Cwt.?

355. If I buy candles at 19 cents a lb., and sell them at 23 cents a lb., what shall I gain per cent?

356. Bought indigo at D1·10 a lb., and sold it at 90 cents a lb.; what was lost per cent?

357. Bought 74 gals. of wine, at D1·10 a gal., and sold it for D80; what was gained or lost per cent?

358. Bought hats at 8s. each, and sold them at 9s. 6d. each; what was gained per cent?

359. If I buy wheat at D1·25 per bushel, how must I sell it, to gain 18 per cent?

360. If a hhd. of rum cost 50 dolls. for how much must it be sold, to lose 10 per cent?

361. If 60 lb. of steel cost *L*3 .. 10, how must I sell it per lb. to gain 15½ per cent?

362. A and B join stock, and make up D600. A puts in D225, and B the rest. They gain D150; what is the share of each?

363. A man dying, left 3 sons, as follows: A, 184 dolls., B 155, and C 96; but when his debts were paid, there were but 363 dolls. left; what is the share of each?

364. A and B companied; A put in *L*135, and took ⅔ of the gain; what did B put in?

365. A, B, and C, entered into partnership. A put in D170 for 8 months, B D120 for 10 months, and C D240 for 3 months; and they lost D82; what is each man's share of the loss?

366. A, B, and C, hold a pasture in common, for which they pay *L*40 a year. In this pasture, A had 80 oxen 76 days, B 72 oxen 50 days, and C 100 oxen 90 days; what must each man pay?

367. In 1817, the London Hibernian Society had in its schools in Ireland, under gratuitous instruction, 32000 poor children, at an average expense to the Society of 5s. sterling each; what is the amount in Federal money?

368. The return of Bonaparte to France from Elba, and his subsequent measures to the battle of Waterloo, are stated to have cost the French nation 1021 millions of francs; how much is that in Federal money?

369. In 1818, the London African Institution for promoting the abolition of the slave trade, expended *L*805 .. 15 .. 9 sterling; how much is that in New-York currency?

370. The bank of England is said to have a capital of *L*14600500 sterling; how much is that in New-England currency?

371. In 1819, the London Prayer Book and Homily Soc. expended *L*2006 .. 11 .. 4 sterling; how much is that in Pennsylvania currency?

372. The London Hibernian Soc. expended *L*8387 .. 16 .. 8 sterling; how much is that in South-Carolina currency?

373. The receipts of the British Naval and Military Bible Soc. were *L*2162 sterling; how much is that in Canada cur.?

374. In 1819, the exports of Russia were to the amount of 43559343 rubles more than their imports, which were 167 millions of rubles; what is the amount, in Federal money, of their exports?

375. The expenditures of the Scottish Miss. Soc. for 1819, were *L*4599 .. 11 .. 11 sterling; what is that in New-Jersey currency?

376. The receipts of the New Hampshire Miss. Soc. for 1820, were D2537·21; what is that in sterling?

377. The receipts of the Boston Jews Soc. were D1195·67; how much is that in Virginia currency?

378. The expenditures of the British and Foreign School Soc. were *L*2432 .. 3 .. 3 sterling; how much is that in North Carolina currency?

379. The Berbice Auxiliary Miss. Soc. composed of slaves, contributed, in 1820, 420 guilders; how much is that in Federal money?

380. The total expenditure of the British and Foreign Bible Society in 17 years, was *L*908248 .. 10 .. 6 sterling; how many livres is that?

381. How much in Federal money?

382. The receipts of the Maine Miss. Soc. in 1820, were D2058·47; how much is that in Georgia currency?

383. The receipts of the Hampshire Missionary Soc. were D1590·59; how much is that in Canada currency?

384. The receipts of the New-York Miss. Soc. in 1807, were D1360·47; how much is that in Irish currency?

385. The receipts of the Vermont Missionary Soc. in 1812, were D652·67; how many livres is that?

386. The receipts of the Connecticut Miss. Soc. in 1816, were D6019·32; how many rubles is that?

387. The receipts of the Connecticut Bible Soc. in 1816, were D2177·20; how many rials of plate is that?

388. The receipts of the Massachusetts Miss. Soc. in 1813, were D3120·04; how much is that in sterling?

389. The receipts of the Massachusetts Society for propagating the Gospel, in 1810, were D2477·80; how much is that in New-England currency?

390. The expenditures of the Massachusetts Society for promoting Christian Knowledge, in 1813, were D1407·62; how much is that in Delaware currency?

391. The receipts of the Berkshire and Columbia Miss. Soc. in 1813, were D811·44; how much is that in New-York currency?

392. The receipts of the American Board for Foreign Missions the first year, were D1399·52; how much is that in South-Carolina currency?

393. The second year, D13953·04; how much is that in Irish currency?

394. The third year, D11436·18; how much is that in Canada currency?

395. How much, in Federal money, did David give Araunah for his threshing floor and oxen, (2 Sam. 24. 24,) it being 50 shekels of silver?

396. How much, for the whole place, (1 Chron. 21. 25,) it being 600 shekels of gold?

397. What was the avoirdupois weight of Absalom's hair, (2 Sam. 14. 26,) it being 200 shekels?

398. How many bushels of flour, and how many of meal, were required daily for Solomon's table, (1 Kings 4. 22,) it being 30 cors of flour, and 60 of meal?

399. What were the dimensions, in feet, of Solomon's temple, it being 60 cubits long, 20 wide, and 30 high?

400 How many wine gallons did the brazen sea contain, being 3000 baths?

401. How many miles was Bethany from Jerusalem, being 15 Hebrew furlongs?

402. How many acres of land were assigned to the Levites as glebes, (Lev. 35. 3—5,) being 1000 cubits square on each of the 4 sides of each of the 48 Levitical cities?

403. George Washington was born Feb. 22, 1732, and died Dec. 14, 1799; how old was he?

404. The population of the New-England states, at each census, was as follows:

	In 1790.	In 1800.	In 1810.	In 1820.
Vermont,	85589	154449	2 7895	235704
N. Hampshire,	141885	183858	2 4460	244161
Maine,	96540	151719	228705	298335
Massachusetts,	378787	422630	472040	523287
Rhode Island,	68825	69122	76931	83059
Connecticut,	237946	251002	261942	275248

What was the number of inhabitants in New England at each census?

405. The population of the Middle States at each census, was as follows:

New-York,	340120	586050	959049	1372812
New-Jersey,	184139	211149	245562	277575
Pennsylvania,	434373	602545	810091	1049398
Delaware,	59094	64273	72674	72749
Maryland,	319728	349692	380546	407350
Dist. Columbia,		8124	24023	33039

What was the number of inhabitants in the Middle States, at each census?

406. The population of the Southern States at each census, was as follows:

Virginia,	747610	885149	974622	1065366
N. Carolina,	393751	478103	555500	638829
S. Carolina,	239073	345591	415115	502741
Georgia,	82548	162686	252433	340989
Alabama,				127901

What was the number of inhabitants in the Southern States, at each census?

407. The population of the Western States at each census, was as follows:

Kentucky,	73677	22095	4065119	564317
Tennessee,	35691	142760	261727	422813
Ohio,		42179	230760	581434
Mississippi,			40352	75448
Louisiana,			76556	153407
Indiana,		4875	24520	147178
Illinois,			12282	55211
Missouri,			20845	66586
Michigan Ter.			4762	8896
Arkansaw Ter.				14273

What was the number of inhabitants in the Western States, at each census?

408. What was the whole number of inhabitants in the United States, at each census?

409. The contributions to the American Board for Foreign Missions, for the year ending Aug. 31, 1820, were, from the several states, as follows: Massachusetts, $14661·71; Connecticut, $6036·68; New York, $3791·41; Vermont, $1848·69; New-Hampshire, $1464·82; Maine, $1451·83; New-Jersey, $1443·51; Georgia, $1280·52; S. Carolina, $764·30; Pennsylvania, $702·30; Maryland, $683·50; N. Carolina, $564·32; Ohio, $392·91; Tennessee, $251·17; Virginia, $209; Louisiana, $200; Rhode-Island, $111·56; Delaware, $105·44; Mississippi, $20; Dist. of Columbia, $10; Choctaw Nation, $169; Cherokee Nation, $8; places unknown, $41·97. How much in all?

410. How much less than half the whole, was contributed by Massachusetts?

411. How much more than half the whole, by Massachusetts and Connecticut?

412. If the amount contributed by Massachusetts, were divided equally among the inhabitants of that state, according to the census of 1820, (See No. 404,) how much would it be for each?

413. If the amount contributed by Connecticut, were so divided among the inhabitants of that state, what would it be for each?

414. If New-York had contributed in the same proportion as Massachusetts, how much would have been raised in that state?

415. If all the states had contributed in the same proportion as Massachusetts, what sum would have been raised in the whole?

416. If the sum which was contributed, enabled the Board to support 88 missionaries and assistants among the heathen, what is that for each?

417. If all the states had contributed in the same proportion as Massachusetts, how many would it have enabled the Board to support, at that rate?

418. In 1810, the number of blacks in the United States, was as follows: Northern states, 31687 slaves, 91317 free; Southern states, 1159677 slaves, 95129 free: how many more slaves than free?

419. In 1818, there were living 1336 ministers of the gospel, graduated at the following colleges, to wit: Harvard, Yale, Columbia, Brown, Dartmouth, Carlisle, Williams, Union, Bowdoin, Middlebury, South-Carolina, Transylvania,

William & Mary; allow 130 more for Princeton, and 84 for other colleges in America and abroad; and how many ministers are there in the United States, who have been educated at college?

420. If the number of ministers who have obtained a sufficient education without going to college, is half as many; how many educated ministers are there in the U. States?

421. If 900 of these are in New-England, how many more are wanted there, to make one for every 800 souls? (See No. 404.

422. How many are wanted in the other states, at the same rate? (See No. 408.)

423. How many souls are there in New-England, to one educated minister?

424. How many in the other states?

425. The population of the United States is said to have doubled once in 23 years; if it should continue to do so, what will it be in the year 1958?

426. The number of ministers educated at college in the United States, has doubled once in 70 years; suppose it to continue to double once in 69 years, and the number of educated ministers in 1820 to be 2390; what will it be in the year 1958?

427. If one minister is necessary for every 800 souls, how many will then be destitute?

428. How many will be destitute, for one that is supplied?

429. Mrs. Norris left $30000 to the American Board for Foreign Missions; what is the annual interest, at 6 per cent?

430. How many missionaries will that support continually, at $500 each per annum?

431. If each of these missionaries should be instrumental in the conversion of 20 heathen souls every year, what will be the whole number in a century?

432. If that interest should be applied to the board and education of heathen children in the mission families at Ceylon, at 12 dolls, each, how many would it constantly support?

433. How many heathen children would thus receive a Christian education, in a century, allowing each to be 4 years at school?

434. If it should be applied to the school expenses of such children as are fed and clothed by their parents, which at Ceylon amount to 48 cents each per annum, how many such children would it keep at school continually?

435. How many heathen children would be educated by it, in this way, in a century, allowing each to be 4 years at school?

435. The exhibition of West's picture of *Christ healing the sick*, produced the sum of $4133·45 to the Pennsylvania hospital, in 1818, from 165 5 visitors; how much is that from each, in Pennsylvania currency?

437. In the year 1274, the price of a small bible, neatly written, was £35 sterling; and the wages of a laboring man were 1½d. per day: how many years, of 313 working days each, must he have labored to pay for a bible?

438. If a laboring man now earns 50 cents a day, how many bibles would the same labor pay for, at 60 cents each?

43 . If one person in 50 in the United States, wears watch trinkets that cost 5 dollars, how much might be saved for doing good by that class of gentlemen, by doing without these useless articles?

440. If one in 200 should save 10 dolls. in this way, what would be the amount.

44 . If one in 1 0 should save 20 dollars in this way, what would be the amoun ?

44 . If one in 0 0 should save 50 dollars in this way, what would be the amount?

4 3. If one in 20000 should save 100 dollars in this way, what would be the amount?

444. What is the whole amount that might be saved by these five classes of gentlemen?

4 5. If classes of ladies, equally numerous, wear ornaments to half that amount, what might they save?

446 Add together the sav ng of the ladies and gentlemen, as above stated, and tell what is the annual interest it would yield, at 6 per cent?

447. How many young men would it assist in obtaining an education for the gospel ministry, at $ 25 each per ann.?

448. How many heathen children might be educated by it in a century, at the rate mentioned in Nos. 434 and 4 5?

449. How many bibles would it annually afford for charitable distribution, at 60 cents each?

450. The first society in P—, N. Y. the population of which does not exceed 450 souls, besides supporting the gospel at home, contributed for the spread of the gospel abroad, in the year 1821, the following sums, to wit: For domestic missions, D43·25; cash to the American Board, D183·57;

clothing, &c. for Indian missions, D341·33; Auburn Seminary, D39; Education and Bible societies, estimated at D25; board and tuition of a charity student, D68; clothing for do. estimated at D30: how much in all?

451. If all the people in the United States should contribute in the same proportion every year, what would be the amount, and how many missionaries would it support, at 500 dollars each?

452. In Oct. 1816, the money divided to school societies in Connecticut, from the school fund, was D20093·73, and in March, 1817, the same sum; and in the same time, there was paid to citizens, as collectors' fees, D13395·82; in the same time, the amount of the state tax payable into the treasury, was D48645·81; how much did the people of Connecticut receive from the treasury that year, more than they paid in?

453. A druggist mixes together several simples, as follows: First, 2 oz. 3 dr. 1 sc.; second, 3 oz. 2 dr. 18 gr.; third, 4 oz. 7 dr. 2 sc.; fourth, 11 oz. 6 dr. 19 gr.: what is the weight of the whole composition?

454. A, B, and C, each owe me 250 dolls.; D, E, and F, each twice that sum; what is the amount?

455. Borrowed of A £25 .. 16 .. 6½, of B £37 .. 16 .. 8, of C £54 .. 6 .. 7½; and paid A £14 .. 19 .. 10, B £10 .. 19 .. 9, C £48 .. 10 .. 11; how much do I still owe?

456. What cost 1945 bbls. flour, at D6·25 per bbl.?

457. What cost 13 lbs. at 4s. 6d. per lb.?

458. If a man who fails in trade, owes 3765 dollars, and is able to pay 45 cents on the dollar, what sum will his creditors lose?

459. In 36 weeks and 4 days, how many seconds?

460. Bought 3 horses for £16 .. 17 .. 7 each, and 2 cows for £5 .. 14 .. 7 each, and 3 bushels of wheat for 18s. 10½d.; what is the whole amount?

461. Divide £11 .. 11 .. 3 by 3.

462. If a debtor pays 7s. 6d. on the pound on £5678, how much will his creditor receive?

463. If 6 men have £3 .. 10 for 4 days work, how much must 36 men receive for 18 days work?

464. Tell the amount of D507·25 in 3 mo. at 7¾ per cent?

465. In 1764 nails, how many ells Flemish?

466. Divide £7 .. 1 .. 9 by 27.

467. What cost 7121 lbs. at 15d. per lb.?

468. What cost 2345 acres, at £2 .. 3 .. 6 per acre?

469. Bought 21 bales of cloth, in each bale 13 pieces, and in each piece 25 ells English, 4 qrs. 3 na.; how much in all?

470. Find the greatest common measure of 246 and 372.

471. Reduce $\frac{1}{5}\frac{9}{7}\frac{2}{6}$ to its lowest terms.

472. Reduce $\frac{2}{3}$, $\frac{3}{5}$, and $\frac{3}{4}$, to a common denominator.

473. Reduce $14\frac{7}{10}$ to an improper fraction.

474. Reduce $1\frac{3}{2}\frac{6}{5}\frac{2}{2}$ to its equivalent number.

475. Reduce $\frac{2}{3}$ of $\frac{3}{5}$ of $\frac{10}{11}$, to a single fraction.

476. Reduce $\frac{2}{3}$ of a farthing to the fraction of a £.

477. Reduce $\frac{5}{8}$ of an acre to its value.

478. Add $\frac{5}{8}$, $7\frac{1}{2}$, and $\frac{1}{3}$ of $\frac{3}{4}$.

479. From $\frac{3}{13}$, take $\frac{4}{30}$.

480. Multiply $\frac{1}{2}$, $\frac{2}{3}$, and 3, continually together.

481. Divide $\frac{16}{25}$ by $\frac{4}{5}$.

482. If $\frac{1}{8}$ of a ship is worth £73 .. 1 .. 3, what part of it is worth £250$\frac{1}{2}$?

483. If a man performs a certain journey in $35\frac{1}{2}$ days, travelling $13\frac{5}{8}$ hours a day; how many days would he be, travelling $11\frac{9}{10}$ hours a day?

484. What quantity of cloth, $\frac{3}{4}$ yd. wide, will line $9\frac{1}{2}$ yds. that is $2\frac{1}{2}$ yd. wide?

485. If £2 .. 5 .. 1 .. $2\frac{2}{3}$ be the interest of £25 for $\frac{5}{6}$ of a year, in what time will £$13\frac{1}{3}$ gain £$1\frac{1}{12}$?

486. Tell the difference between 1·9185 and 2·73.

487. Tell the product of 3 by ·3.

488. Tell the quotient of ·48624097 by 179.

489. Reduce $\frac{3}{8}$ to a decimal.

490. Reduce 5 oz. 12 dwt. 16 gr. to the decimal of a lb.

491. Tell the value of ·009943 of a mile.

492. What cost 6·25 hhds. of wine, at 1·2s. a pint?

493. If 2 persons receive 4·625s. for one day's labor, how much should 4 persons receive for 5·25 days' labor?

494. Tell the product of 4 ft. 7 in. by 9 ft. 6 in.

495. Of 12 ft. 5 in. by 6 ft. 8 in.

496. Of 35 ft. $4\frac{1}{2}$ in. by 12 ft. 3 in.

497. Find the content of a load of wood 6 ft. 4 in. wide, 4 ft. high, and 7 ft. 8 in. long.

498. How many solid feet in a bale of cotton 7 ft. 6 in. long, 3 ft. 8 in. wide, and 3 ft. 3 in. thick?

499. Find the solid content of a stick of squared timber, 20 ft. 3 in. long, 1 ft. 2 in. broad, and $11\frac{1}{2}$ in. thick.

500. Find the cube of 29.

501. The square of 624.
502. The cube of 101.
503. The square of 4·16.
504. The cube of 3·5.
505. The square of $\frac{2}{3}$.
506. The cube of $\frac{5}{8}$.
507. The 4th power of $\frac{3}{4}$.
508. The square root of 29506624.
509. The cube root of 48223·544.
510. The 4th root of 194481.
511. The square root of $\frac{2}{3}\frac{5}{6}$.
512. The cube root of 39304.
513. The cube root of $\frac{5}{7}\frac{12}{9}$.
514. The square root of $\frac{27}{47}$.

515. Bought 13 yds. of cloth, at 2d. for the first yd., 4d. for the second, 6d. for the third, and so on; what was the amount?

516. Bought 100 acres of land, at 1 doll. for the first acre, 2 dolls. for the second, 3 dolls. for the third, and so on; what was the amount?

517. Fourteen persons bestowed charity upon a beggar, the first giving 3d., the second 6d., the third 9d., and so on; what did the last person give, and what did the beggar receive?

518. A debt is to be discharged at sixteen several payments, the first to be £6, and the last to be £200; what is the common difference of the payments, and what is the whole debt?

519. Sold 10 yds. of cloth, the first for 3s., and the last for £2 .. 8; what was the common difference?

520. A certain person married off his daughter on New-Year's day, and gave her 5 dollars towards her portion, promising to double it on the first day of every month through the year; what is the amount?

521. Bought a horse, with 4 shoes on, and 8 nails in each shoe, at 1 cent for the first nail, 2 for the second, 4 for the third, and so on; what was the price of the horse?

522. Sold 30 acres of land, at 2 hob-nails for the first acre, 6 for the second, 18 for the third, and so on; and sold the nails for a farthing per 100; how much did I gain, if I gave £50 per acre for the land?

523. Mixed 20 bushels of wheat at 5s., 36 of rye at 3s., and 40 of barley at 2s.; how much is a bushel of the mixture worth?

524. A merchant would mix wines, at 17s., 18s., and 22s. per gallon, so that the mixture may be worth 20s. a gallon; what quantity of each must be taken?

525. It is required to mix brandy at 8s., wine at 7s., cider at 1s., and water at 0 per gallon, so that the mixture may be worth 5s. per gallon; what quantity of each must be taken?

526. What number is that, which being increased by $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ of itself, the sum will be 125?

527. What number is that, which being multiplied by 7, and the product divided by 6, the quotient will be 14?

528. One being asked his age, said, if $\frac{3}{5}$ of the years I have lived be multiplied by 7, and $\frac{2}{3}$ of them be added to the product, the sum will be 292; how old was he?

529. A son aking his father how old he was, received this answer: Your age is now one fourth of mine; but 5 years ago, it was only one fifth of mine. What was the son's age?

530. How many days can 9 persons be placed in a different position at dinner?

531. How many different ways can the 6 vowels be put together?

532. How many combinations can be made of 5 letters out of 20?

533. Tell the interest of £365·123, for 7·8 years, at 5 per cent.

534. Of £325·5, for 8·5 years, at 6 per cent.

535. Tell the amount of *L*35·7, in 6·25 years, at 7·5 per cent.

536. Of £123·65, in 10 years, at $6\frac{1}{4}$ per cent.

537. What principal will amount to £565, in 4 years, at 5 per cent?

538. What is the present worth of £390, payable in 5 years, at 6 per cent discount?

539. At what rate per cent will £300 amount to *L*428·25, in 9·5 years?

540. In what time will *L*400 amount to *L*491, at 6·5 per cent?

541. In what time will £525 amount to *L*603·75, at 5 per cent?

542. What is the amount of *L*250, for 3 years, at 6 per cent, compound interest?

543. What is the compound interest of £350, for 5 years, at 4 per cent?

544. What principal, at 5 per cent, compound interest, for 4 years, will amount to D972·405?

545. What principal, at 4 per cent, compound interest, for 5 years, will amount to *L*6691·5909632?

546. In what time will £17500 amount to *L*22334·92734375 at 5 per cent, compound interest?

547. At what rate per cent will £225 amount to *L*263·218176, in 4 years?

548. At what rate per cent will *L*1234 amount to *L*1469·713744, in 3 years?

549. What is the amount of an annuity of D600, for 5 years, allowing simple interest at 6 per cent?

550. What is the amount of an annuity of D500, for 4 years, allowing simple interest at 7 per cent?

551. Find the present worth of an annuity of D200, to continue 4 years, at 5 per cent, simple interest.

552. Find the amount of an annuity of D100, for 4 years, allowing compound interest at 6 per cent.

553. What is the amount of an annuity of *L*200, for 3 years, allowing compound interest at 4 per cent?

554. What is the present worth of an annuity of *L*100, to continue 4 years, discount at 4 per cent, compound interest?

555. Find the present worth of an annuity of D300, to continue 3 years, discount at 6 per cent, compound interest.

556. Find the present worth of a perpetuity of D100, discounting at 4 per cent, compound interest.

557. What must I give for an annuity of *L*50, to continue forever, discounting at 6 per cent, compound interest?

558. What perpetuity can be purchased for D1200, allowing discount at 5 per cent, compound interest?

559. What must I give for a perpetuity of D80, to commence 4 years hence, discounting at 4 per cent, com. int.?

560. Which is the most valuable, and how much so, an annuity of D200 a year for 10 years, or a perpetuity of D200, to commence 10 years hence, discounting at 4 per cent, compound interest?

561. Find the area of a triangular field, one side of which measures 186 poles, and the perpendicular upon it, from the opposite angle, 24 poles.

562. Find the area of a triangular field, the three sides of which measure 126 poles, 100 poles, and 86 poles.

563. Find the area of a field of six sides, which being divided into 4 triangles, the bases and perpendiculars measure as follows:

triangles.	*bases.*	*perpend.*	*triangles.*	*bases.*	*perpend.*
No. 1	48 poles,	14 poles,	No. 3	47 poles,	18 poles,
2	36	12	4	80	10

564. What is the area of a circle, whose diameter is 10 poles?

565. What is the circumference of a circle, whose diameter is 25 rods?

566. Find the diameter of a circle, whose circumference is 278 rods.

567. If a piece of ground of 7 sides, one of which is 78 rods, contains 12 acres, what will be the content of another piece of the same shape, the similar side of which is 25 rods?

568. If the diameter of one circle is 20 rods, what must be the diameter of another, to contain 3 times as much ground?

569. What is the height of a tree, when, if you set up a perpendicular pole 20 feet above ground, and take such a station that your eye is in a range with the top of the tree and the top of the pole, your eye is 5 feet from the ground, and your station 10 feet from the pole, and 64 from the tree?

570. What is the breadth of a river, according to Problem 7, of Mensuration, when EF is 15 rods, FD 35 rods, and DA 135 rods?

571. Find the number of solid feet is a stick of squared timber, which measures at the butt end, 16 inches by 14, and at the small end, 14 by 10, and is 45 feet long?

572. Find the superficial content of a pyramid, the base of which is 12 feet square, and the slant height 25 feet.

573. Find the solid content of a cone, the diameter of whose base is 10 feet, and the height 30 feet.

574. If a cone, the diameter of whose base is 6 feet, contains 150 solid feet, what must be the diameter of the base of a similar one, that shall contain 300 feet?

575. What is the solid content of a stick of round timber, whose diameter is 15 inches, and the length 50 feet, the diameter being the same throughout?

576. What is the superficial content of a globe, whose diameter is 25 inches?

577. In 600*l.* Canada, how much New-York?

578. Reduce $2\frac{9}{17}\frac{1}{8}$ to its equivalent number.

579. What cost 7100, at $6\frac{3}{4}$d. each?

580. Tell the least common multiple of 7, 8, 9, and 10.

581. Reduce $\frac{3}{5}\frac{0}{4}\frac{0}{8}$ to its lowest terms.

582. Reduce $\frac{2}{9}$ of an inch to the fraction of a yard.

583. Reduce $\frac{2}{9}$ of an English guinea to sterling.

584. In 40 *l.* sterling, how much Kentucky?

585. Tell the value of $\frac{4}{5}$ of a £.

586. In 400*l.* sterling, how many livres?

587. Multiply 2·714 by 100.

588. Multiply ·3 by ·3.

589. Divide ·6 by 6.

590. Add $\frac{2}{3}$, $\frac{3}{5}$, and $\frac{5}{7}$.

591. Tell the superficial content of a globe, whose circumference is 6 feet.

592. Tell the number of solid inches in a globe, whose diameter is 3 feet.

593. What is the number of wine gallons which a cask will contain, of which the head diameter is 36 inches, the bung diameter 40 inches, and the length 56 inches?

594. Find the number of tons a ship will carry, when the length of the keel is 150 feet, and the breadth of the beam 80 feet.

595. How many solid inches in an irregular stone, which being put into a cubical vessel, and the vessel filled with water, and the stone being taken out, the space left empty measures 15 inches long, 15 wide, and 4 deep?

596. If a man weighing 100 lbs. rest on the end of a lever, 12 feet from the prop, what weight will he balance at the other end of it, 8 inches from the prop, no allowance being made for the weight of the lever?

597. If a power weighing 50 lb. be applied to the end of a rope, round a wheel whose diameter is 4 feet, what weight will it balance suspended to a rope which goes round an axle 6 inches in diameter, no allowance being made for friction?

598. What is the height of a steeple, from the top of which a bullet being let fall, strikes the ground in 4 seconds?

599. Salisbury steeple, in England, is supposed to be 400 feet high; how long would it take a bullet to fall from its top to the ground?

600. How deep is a chasm, into which, if you drop a stone, it is 8 seconds before you hear it strike the bottom?

601. The population of North America is estimated as follows: United States 9640000, British possessions 1420000, Indians in both 510000, Floridas 25000, Mexico 7500000, Guatimala 1200000, British West Indies 850000, Spanish do. 900000, French 150000, Dutch 80000, Danish 40000, Hayti 500000; how many in all?

602. Of South America as follows: New-Grenada 1600000, Caraccas 900000, Peru 1500000, Chili 900000, Buenos Ayres 1100000, Portuguese Brazil 2000000, Guiana 500000, In-

dians in Brazil 2000000, in Amazonia 3000000, in Patogonia, &c. 150000; how many in all?

603. Of Europe as follows: Great Britain and Ireland 16816000, Sweden 1377000, Norway 912000, Denmark 1645000, Russia 33829000, Prussia 9737000, Holland 2002000, Netherlands 4140000, France 26775000, Austria 24646000, German states 15000000, Switzerland 1768000, Spain 10396000, Portugal 3559000, Italy 16117000, Turkey 9882000, various islands 275000; how many in all?

604. Of Asia as follows: Russia 14 millions, Turkey 12, Persia 22, Arabia 11, Hindoostan 100, Burmah 20, Siam, Malacca and Laos 10, Japan 30, Chinese empire 250, Indian Archipelago 20, Independent Tartary 2, Australasia 5, Polynesia 2, Ceylon and other islands 2; how many in all?

605. The population of Africa is estimated at 98945000, of which the empire of Morocco is said to contain 14886000, Algiers 1500000, Tunis 3 millions, Tripoli 1 million, Egypt 3500000, Nubia 2500000, Abyssinia 2 millions, Madagascar 4 millions, British colonies 130000, British, Spanish and Portuguese islands 500000; and the rest are savages; how many are th last?

606. The seven most populous cities of Asia, are Pekin, containing 3 millions; Nankin, 2 millions; Canton, 2 millions; Fo-han, Hang-tchau, King-te ching, and Jeddo, each 1 million: how many people in these seven cities?

607. The next ten cities in Asia, are, Calcutta, containing 650000 inhabitants, Surat 600000, Miaco 529726, Benares 500000, Patna 500000, Susa 500000, Ispahan 400000, Madras 300000, Erzerum 270000, and Aleppo 250000; how many less in these ten, than in the foregoing seven?

608. The seven most populous cities of Europe, are, London, containing 1200000 inhabitants, Paris 715595, Constantinople 500000, Naples 412489, Lisbon 350000, Moscow 300000, and Petersburgh 271137; how many less in these, than in the seven first cities of Asia?

609. The next ten, are, Vienna, containing 252049, Amsterdam 217024, Dublin 190000, Berlin 169000, Madrid 156672, Palermo 150000, Barcelona 147000, Edinburgh and its port 138235, Venice 137240, and Rome 129000; how many less in these ten, than in the preceding seven?

610. The seven most populous cities of Africa, are, Fez, containing 380000 inhabitants, Cairo 300000, Morocco 270000, Tunis 150000, Mequinez 110000, Sennaar 100000, and Al-

giers 80000; how many less in these, than in the seven first cities of Europe?

611. The seven most populous cities in America, are, Rio Janeiro, containing 150000 inhabitants, Mexico 137000, New-York 123706, Philadelphia 118630, St. Salvador 110000, Potosi 100000, and Buenos Ayres 70000; how many less in these, than in the seven first cities of Africa?

612. The Netherlands contain 17500 square miles, and 4140235 inhabitants; how many is that to a square mile?

613. The Italian possessions of Austria contain 17483 square miles, and 3820128 inhabitants; how many is that to a square mile?

614. The earth contains 199 millions of square miles, of which 160 millions are sea and parts unknown; how many square miles compose the habitable world?

615. Of the habitable world, America contains $\frac{140}{390}$, Asia $\frac{105}{390}$, Africa $\frac{95}{390}$, Europe $\frac{26}{390}$, and New-Holland the rest; how many square miles in the last?

616. According to Melish's map of the United States, the number of square miles within their limits, from the Atlantic to the Pacific, is 2256955. If the population should increase to the amount mentioned in No. 425, how many will it be to a square mile?

617. According to the map of the land of Canaan, as divided by Joshua, it contained 8362 square miles; from which, deduct the territory of the Sidonians, 50 miles long and 8 broad, and that of the Philistines, 40 long & 15 broad; and how many square miles were left for the Israelites?

618. The Israelites, in the time of Solomon, are supposed to have been seven millions; if so, how many is that to a square mile?

619. In 1801, the population of Great Britain was stated as follows: England 8331434, Wales 541546, Scotland 1599068, Army and Navy 470598; how many in all?

620. In 1811, as follows: England 9499400, Wales 607380, Scotland 1804864, Army & Navy 640500; how many in all?

621. What was the increase per cent in those 10 years?

622. Allowing the same increase per cent for the next ten years, what would be the population in 1821?

623. If England and Wales had increased at that rate per cent, what would their proportion be in 1821?

624. It is estimated that there are, in England and Wales, 10434 Episcopal clergymen, and as many dissenters. If the whole population were equally divided among them all, how many souls would constitute the charge of each minister?

625. The number of Synods, Presbyteries, and Ministers in the established church in Scotland, in 1803, were as follows:

Synods.	*Presb.*	*Min.*	*Synods.*	*Presb.*	*Min.*
Lothian and Tweedale,	7	116	Aberdeen,	8	101
Merse and Teviotdale,	6	66	Moray,	7	54
Dumfries,	5	54	Ross,	3	23
Galloway,	3	37	Sutherland & Caithness,	3	23
Glasgow and Ayr,	7	130	Argyle,	5	41
Perth and Sterling,	5	80	Glenelg,	5	29
Fife,	4	71	Orkney,	4	30
Angus and Mearns,	6	81			

How many Presbyteries, and how many ministers in all?

626. Suppose there were 100 Burgher ministers, 30 Antiburghers, and 250 of other denominations; and add the ministers of the established church, and divide among them the whole population of Scotland, as it was in 1801, (See No. 619;) and how many souls will be to each?

627. The number of Synods, Classes, and Ministers, in the established church in Holland, in 1803, was as follows:

Synods.	*Classes.*	*Min.*	*Synods.*	*Classes.*	*Min.*
Guelderland,	9	245	Friesland,	6	207
South Holland,	11	331	Overyssel,	4	84
North Holland,	6	220	Drente,	3	40
Zealand,	4	163	Groningen,	7	161
Utrecht,	3	79	On the island of Ameland,		2

How many Classes, and how many Ministers in all?

628. There were also, of other denominations, as follows: Walloon Calvinists, 50 ministers; English Presbyterians, 7; Scotch do. 1; Episcopalians, 2; Catholics, 400; Lutherans 70; Remonstrants, 43; Baptists, 251; Rhinsburghers, 20; Armenians, 1: how many in all?

629. Deduct 50000 Jews from the population of Holland, as stated in No. 603, and divide the remainder among all the ministers; and how many souls will there be to each?

630. Of the population of Russia in 1819, it was stated that 31262000 were of the established church; and the number of clergymen in that church in 1805, was stated as follows: Protoires, Priests, and Deacons, 44187; Readers and Sacristans, 54239. If this population were divided equally among all the clergy, how many souls would there be to each?

631. The number of Methodists in 1805, was as follows: In Great Britain 101915, Ireland 23321, Gibraltar 40, West Indies 22650, America 102328; how many in all?

632. In 1819, the number in the United States was as follows: Ohio Conference 29134, Missouri 4764, Tennessee 20676, Mississippi 2871, S. Carolina 32646, Virginia 22585, Baltimore 32796, Philadelphia 32796, New-York 22638, New-England 15312, Genesee 23913: how many in all?

633. The number of travelling preachers was 812; how many were under the care of each, on an average?

634. The number of local preachers was stated to be more than 1000; suppose them to be 1188; and how many members would there be to a preacher?

635. The same year, the number under the care of the British and Irish Conferences, was 242459; how many were in all the world?

636. The following statement of the number of Baptists in the United States, is compiled from the returns made to their Gen. Convention in 1821. Where there were blanks in those returns, they are filled by estimates, and marked with an asterisk. The number in New-England is stated as follows:

	min.	*chhs.*	*mem.*		*min.*	*chhs.*	*mem.*
Maine,	129	171	9740	Massachusetts,	105	109	10078
N. Hampshire,	34	44	2765	Rh. Island,	41	54	6052
Vermont,	97	121	9978	Connecticut,	59	60	6946

How many ministers, how many churches, and how many members?

637. In the Middle states, as follows:

New-York,	304	426	35200	Delaware,	7	7	558
N. Jersey,	22	23	2225	Maryland,	19	36	806
*Pennsylvania,	76	81	5976	Columbia Dist.	11	16	1511

How many ministers, how many churches, and how many members?

638. In the Southern states, as follows:

*Virginia,	157	300	21000	Georgia,	101	181	14578
*N. Carolina,	198	233	11924	*Alabama,	42	61	2521
*S. Carolina,	95	190	14401	*Mississippi,	36	68	2006

How many ministers, how many churches, and how many members?

639. In the Western states, as follows:

*Tennessee,	123	170	9767	*Indiana,	61	102	3886
*Kentucky,	240	395	27299	Illinois,	19	15	332
*Ohio,	87	150	5557	*Missouri,	27	37	726

How many ministers, how many churches, and how many members?

640. Take the total of the ministers, churches, and members, in the preceding four questions, and add the seventh day Baptists, estimated at 15 ministers, 20 churches, and 2000 members; and what is the amount?

641. How many more churches than ministers?

642. In 1821, the General Assembly of the Presbyterian Church in the United States, had under its care 92 Presbyteries, of which 50 reported 1800 congregations, 734 ordained, and 103 licensed preachers; if those which did not report, contained each two thirds as many in proportion as those which did, how many congregations, and how many preachers in all?

643. If every preacher supplied a congregation, how many congregations were destitute?

644. In 651 congregations, the number in communion was 71364; what is the average to each?

645. If the rest contained an average of the same number each, what would be the whole number of communicants in that connection?

646. In 1820, the several Congregational associations of New-Hampshire, reported as follows:

	min.	*chhs.*		*min.*	*chhs.*
Deerfield,	8	9	Orange,	8	12
Haverhill,	6	8	Piscataqua,	16	16
Holles,	4	5	Plymouth,	3	6
Hopkinton,	11	12	Union,	7	9
Monadnock,	14	17	Coos.	3	10

If there are 10 ministers and 10 churches not connected with these associations, and 8 licensed preachers; what is the whole number of preachers and churches of this order in New-Hampshire?

647. In 81 of these churches, there were 8843 members; if the rest averaged the same number each, what was the whole number of members?

648. In 1810, the Congregational ministers and licentiates in the several associations in Vermont, were as follows:

	M.	*L.*		*M.*	*L.*
Windham,	13	0	Royalton,	11	0
Rutland,	19	7	Orange,	13	5
Addison,	13	2	N. Western,	8	0

How many in all?

649. In 1814, the number was 79 settled ministers, 10 unsettled, & 8 licentiates; what was the increase in 4 years

650. At the same rate of increase, what would be the number in 1820?

651. If there were 140 churches of 109 members in each, how many members were there in all?

652. In 1820, the ministers and churches connected with the Congregational Associations of Connecticut, were as follows:

	min.	*chhs.*		*min.*	*chhs.*
Hartford North,	21	20	Fairfield East,	8	12
Hartford South,	16	16	Windham,	20	23
New-Haven West,	16	19	Litchfield North,	18	18
New-Haven East,	11	13	Litchfield South,	15	18
New-London,	15	21	Middlesex,	15	15
Fairfield West,	10	15	Tolland,	15	15

Besides which, there were 21 unsettled ministers, and 9 licensed preachers; how many ministers, how many churches, and how many members, if the churches average 109 each?

653. The number of settled Congregational ministers in Massachusetts, was stated, in 1816, to be 323. Suppose them, in 1820, to be 330, and the number of vacant churches to be 50; suppose the unsettled ministers and licentiates to be 30, and the churches to average 109 members; and what is the number of Congregational ministers, of churches, and of members, in Massachusetts?

654. The number of settled Congregational ministers in Rhode-Island, was stated, in 1816, to be 8. Suppose them, in 1820, to be 9, and the number of vacant churches to be 4; suppose the unsettled ministers and licentiates to be 3, and the churches to average 109 members; and what is the number of ministers, of churches, and of members, in Rhode-Island?

655. Suppose there are, in the states out of New-England, 110 Congregational ministers, and 150 churches of 109 members each, and in Maine the same as in Vermont; and what is the whole number of ministers, churches, and members, in the United States?

656. The number of ministers and churches of the Associate Reformed Presbyterians, in 1816, was as follows: Synod of New-York, 2 Min. 32 Chhs.; Pennsylvania, 9 Min. 23 Chhs.; Sciota, 23 Min. 53 Chhs.: how many ministers, how many churches, and how many members, if they average at 109 members each?

657. Suppose the Associate Presbyterians to be 20 ministers and 30 churches, and the Cumberland Presbyterians to be 25 ministers and 40 churches, and that these churches average 109 members each; and how many ministers, churches, and members, in these two bodies?

658. The Dutch Reformed Church, in 1820, contained the following classes, ministers, and churches:

Classes of	*min.*	*chhs.*	*Classes of*	*min.*	*chhs.*
New-York,	16	15	Albany,	10	16
New-Brunswick,	9	10	Washington,	4	9
Bergen,	9	13	Poughkeepsie,	8	11
*Paramus,	8	11	Ulster,	8	20
*Long-Island,	7	9	*Montgomery,	11	14
Philadelphia,	7	6	*Rensselaer,	5	6

Besides which, there were 4 licentiates reported, and probably as many more not reported; if so, how many ministers, and churches, in that body?

659. Of these churches, 67 reported 9023 communicants; if the rest averaged 109 each, what is the whole number?

660. The German Reformed Church, in 1821, reported as follows:

	min.	*cong.*		*min.*	*cong.*
In Pennsylvania,	50	246	N. Carolina,	1	28
Ohio,	5	52	S. Carolina,	0	8
Maryland,	7	34	Tennessee, Kentucky, & elsewhere,		
Virginia,	4	33	(estimated,)	13	99

Besides which, there were 10 licentiates; how many ministers, how many congregations, and how many communicants, if the congregations average 30 each?

661. Add the ministers, churches, and members, as above stated, of the General Assembly, the Congregationalists, the Associate Reformed, the Associate and Cumberland Presbyterians, the Dutch and German Reformed Churches; and find how many ministers, how many churches, and how many members in communion.

662. The number of Episcopal clergymen in the United States in 1817, was stated as follows: New-Hampshire, 4; Massachusetts, 13; Vermont, 4; Rhode-Island, 4; Connecticut, 35; New-York, 67; New-Jersey, 11; Pennsylvania, 25; Delaware, 3; Maryland, 36; Virginia, 33; N. Carolina, 3; S. Carolina, 17: how many in all?

663. In 1821, there were 9 bishops, 200 presbyters, and 124 deacons; what was the increase in 4 years?

664. Of these, there were, in the diocese of New-York, 77; Maryland, 51; Virginia, 33; Ohio, 5: how many in the other five dioceses?

665. If there are 500 churches, with 80 communicants in each, what is the whole number?

666. If the number of Lutheran ministers is 100, and their churches 150, with 80 members in each; what is the number of their communicants?

* Estimates.

667. What is the whole number of preachers of all the above denominations, according to Nos. 633, 634, 640, 661, 663, and 666?

668. If 500 of these ministers are employed as officers of colleges, instructors of academies, or are, from various causes, not employed as ministers; and the rest, except the Methodists, are all engaged in supplying each one church; how many churches are destitute?

669. How many more preachers are wanted, that every 800 souls in the United States may have one to supply them?

670. What is the whole number of communicants of all the above denominations?

671. How many are not communicants of any of these denominations, for one that is?

672. The expenditures of the Worcester county charitable society in 1817, were, for education, $703·48; foreign missions, $204·92; feeble churches, $280; bibles, &c. $57·45; contingent expenses, $5·05: how many guilders in the whole?

673. The expenses of the Deaf and Dumb Asylum at Hartford, in the year 1818, were, for buildings and lands, $3860·85; for tuition, $3283·67; board of pupils, $8398·80: how many rubles in the whole?

674. The receipts were, donations, $7528·48; paid by pupils, $5843·20; contributions from churches in Connecticut, $2646·12; interest of fund, $1018·42: how many millreas in the whole?

675. The payments of the Female Society in Boston for the conversion of the Jews, in 1818, were, for board, &c. of N. Myers, D40; sent the Society at London, D444·44; for the education of Jewish children at Bombay, D100; printing, D23·50; freight, D2·35; exchange, D6.91; deposited in bank, D129: how many marcs banco in the whole?

676. In Liberty county, Georgia, there was said to have been contributed, in 1818, for charitable and religious purposes, by 75 persons, as follows: For free schools, D1600; bible society, D2000; clergymen, D3000; female asylum, D650; missionary, tract, and education societies, D1000. If 37 persons paid D5 each, what was the average to the rest?

677. A laboring man in Vermont, saved the following amount in one year, for charitable purposes: By working on the 4th of July, 75 cents; by not wearing a cravat, one dollar; by doing without ardent spirits, one dollar; by having his cloth only colored, but not dressed, D1·25; by wearing,

himself and family, thick shoes, 4 dollars: what was the amount?

678. If every tenth person in the United States would "go and do likewise," how great a fund would it annually raise?

679. In 1821, Rev. Mr. Ward collected for the Baptist Mission College at Serampore, in New-York, D2467·19; Boston, D1860·62; Philadelphia, D1202·62; Baltimore, D420; Washington, D2.1; Princeton, D242; New-Haven, D406·50; Hartford, D281·06; Providence, D312·68; Alexandria, D40; Newark, D93·19; Pawtucket, D59; Middletown, D103; Schenectady, D190; Worcester, D180·37; Cambridge, D181; Salem, D200·72; Portland, D241·06; North-Yarmouth, D85·73; Portsmouth, D84·42; eleven other towns in Massachusetts, D701·04: how much in all?

680. Kean, the play-actor, visited several of our principal cities near the same time, and received for himself about D50000, for his winter's wages; how many missionaries would that support for six months, at D500 a year each?

681. The expenses of the Richmond theatre for the two last seasons, were stated, in 1821, to have exceeded the receipts by D19884; how many bibles would that furnish for distribution, at 60 cents each?

682. The receipts of the Domestic Missionary Society of Massachusetts, for 1820, were D619·63; the balance on hand from the former year, was D380·15; and the expenditures of that year were D644·48: what was left?

683. The receipts of the Connecticut Missionary Society, for 1818, were, donations and interest, D3052·21½; contributions, D3213·24½; and the expenses were D7244·57: what was the excess of expenditure?

684. The productive property of the Massachusetts Missionary Society, in 1821, was D5327·28; what is the annual interest, at 6 per cent?

685. If the expense of the American Board is D57144, and should be equally divided among the inhabitants of Massachusetts, how much would it be for each? (See No. 404.)

686. In 1803, the Society in Scotland for propagating the gospel at home, had sent out in all, 100 missionaries, and had received in all, *L*2683 .. 5 .. 11, and paid for tracts, *L*356 .. 0 .. 9; what was there left for each missionary?

687. In 1793, there were 4 missionaries in India; in 1809,

there had been added 5 Episcopalians, 14 Baptists from Europe, 3 Hindoo Baptists, 1 Presbyterian, 6 Independents, 2 Lutherans; besides which, there were 3 missionaries in Ceylon, and 1 in China; how many in all?

688. In a certain town in the interior of New-England, containing 3000 inhabitants, there was raised, in 1803, for schools, D800; the poor, D1000; taxes, D900; support of ministers, D670; highways, D3000; incidental expenses, D1000: how much is that for each inhabitant?

689. In the same year, there were retailed in the town, 10230 gals. of N. E. rum, at 61 cents a gal.; 5900 gals. W. I. rum, at D1 a gal.; 1500 gals. brandy, at D1·50 a gal.; and 780 gals. gin, at D1·50 a gal.: what is the expense for each inhabitant?

690. What quantity of ardent spirits for each?

691. In a certain district of Bengal, in two months of 1812, 70 widows were burnt alive on the funeral piles of their deceased husbands; how many would that be in a year?

692. These 70 left 184 orphan children; how many were left by the whole, at the same rate?

693. Within 30 miles of Calcutta, there were 275 widows burnt alive in 1803; if that extent contains 785000 inhabitants, how many would be burnt in the whole of Hindoostan, at the same rate? (See No. 604.)

694. If there are 35000 widows annually burnt alive in the whole of Hindoostan, as is supposed to be the fact, how many orphans are thus annually made, at the above rate?

695. There are 12 pilgrimages annually made to the single temple of Juggernaut in Orissa, at each of which from 100000 to 600000 persons attend, of which a vast proportion (some think a large majority) never return home, but die, from want, fatigue, fevers, &c. Suppose the average attendance to be 300000, and that of these, only one in five die; what is the number of lives annually sacrificed to this one Idol?

696. In the wars kindled by the ambition of Bonaparte, from 1800 to 1815, it is estimated that the following lives were lost: In Hayti, 160000; in the war with England, during 12 years, 200000; in the invasion of Egypt, 60000; in the winter campaign of 1805 and 1806, one hundred and fifty thousand; in Calabria, 2 years, 500000; in the North, in 1806 and 1807, three hundred thousand; in Spain, seven years, 2100000; in Germany and Poland, in 1809, three hundred thousand; in the invasion of Russia, one million;

in the subsequent year, 450000; from his return from Elba, to his last dethronement, 200000: how many lives were sacrificed to the ambition of that one man?

697. The Deluge took place 2348 years before the Christian era; from that to the building of Babel, was 101 years; from that to the beginning of the kingdom of Egypt by Mizraim, 59 years; from that to the beginning of the kingdom of Sicyon, 99 years; from that to the beginning of the kingdom of Assyria, 30 years; from that to the birth of Abraham, 63 years; from that to the founding of Argos by Inachus, 140 years: and from that to the selling of Joseph into Egypt, 128 years: in what year did each of these take place?

698. The kingdom of Athens was begun by Cecrops, 1556 years before the Christian era; from that to the building of Troy by Scamander, was 10 years; from that to the building of Thebes by Cadmus, 53 years; from that to the departure of the Israelites from Egypt, 2 years; from that to the Argonautic expedition, 228 years; from that to the destruction of Troy, 79 years; from that to the building of Alba Longa, 32 years; from that to Saul's being made king of Israel, 57 years; and from that to the death of Codrus, the last king of Athens, 25 years: in what year did each of these take place?

699. Solomon's temple was dedicated 1004 years before the Christian era, and the kingdom of Israel and Judah was divided 29 years after that, and Homer flourished 68 years after that, and Lycurgus flourished 23 years after that, and Carthage was built 15 years after that, and the first Assyrian empire was ended 49 years after that, and Rome was built 67 years after that, and the kingdom of Israel was ended 32 years after that, and Draco flourished 98 years after that; in what year did each of these take place?

700. Nineveh was destroyed 612 years before the Christian era, and the Babylonish captivity began 6 years after that, and Solon flourished 15 years after that, and the kingdom of Judah was ended 4 years after that, and Babylon was taken by Cyrus 49 years after that, and the Jews returned from captivity 2 years after that, and Confucius flourished 15 years after that, and Rome became a republic 12 years after that, and Nehemiah was governor of Judea 54 years after that; in what year did each of these take place?

701. Socrates died 400 years before the Christian era, and Plato flourished 12 years after that, and Aristotle and De-

mosthenes flourished 48 years after that, and Alexander the Great began to reign 4 years after that, and died 13 years after that, and Euclid flourished 32 years after that, and the first Punic war began 27 years after that, and Archimedes flourished 40 years after that, and the second Punic war began 6 years after that, and the battle of Cannæ was 2 years after that, and Judas Maccabeus flourished 50 years after that; in what year did each of these take place?

702. The third Punic war began 149 years before the Christian era, and Carthage was destroyed 2 years after that, the Jugurthine war began 36 years after that, and Sylla became dictator 29 years after that, and Cicero flourished 22 years after that, and the battle of Pharsalia was 12 years after that, and the death of Cæsar was 4 years after that, and Rome became an empire under Augustus 13 years after that, and our Saviour was born 27 years after that; in what year did each of these take place?

703. In the year 1813, the war expense of Great Britain was estimated at 540 millions of dollars; France, and her tributaries, 620 millions; Sweden, Denmark, Russia, Prussia, Austria, and their allies, 800 millions; Spain and Portugal, 150 millions; United States, 50 millions: Spanish colonies, 100 millions: what is the whole amount of the expense of war, to these professedly Christian nations, in that single year?

704. How many ministers of the gospel of peace, would that sum support, at $700 each?

705. If the whole population of the world should be divided equally among them, how many souls would it be to each? (See No. 13.)

706. The report of the Secretary of the Treasury of the United States, at the close of the year 1815, stated the public debt contracted during the last war with Great Britain, to be 80 and a half millions of dollars; how much is that to each individual of the United States, according to the census of 1810? (See No. 408.)

707. How many bibles would it have furnished for the destitute, at 60 cents each?

708. If you use one tea-spoonful of sugar in a cup of tea, and drink 6 cups in a day, and 4 tea-spoonfuls of sugar weigh an ounce, and the sugar costs 15 cents a lb.; how much can you save in a year, for doing good, by drinking your tea without sugar?

709. How many persons must do without sugar in their

tea, that the saving may maintain a Christian free school in Ceylon for 50 heathen children, when such a school costs 2 dollars a month?

710. If you smoke 3 cigars a day, and they cost 6 cents a dozen; how many bibles would the amount send to the destitute in a year, at 60 cents each?

711. If a lady expends 6 cents a week for snuff, how many pages of tracts would the amount pay for in a year, at 1 mill a page?

712. If a gentleman smokes 6 Spanish cigars in a day, at 20 cents a dozen, how much might he save in a year for doing good, by denying himself that indulgence?

713. How many heathen children might be educated by that saving, in 20 years, at the rate mentioned in Nos. 434 and 435?

714. If a gentleman wears out 3 shirts in a year, and the additional expense of ruffles is 75 cents each; and if he wears 2 a week, and the additional expense of washing and ironing is 2 cents a piece each time; how much can he save in a year for doing good, by wearing plain shirts?

715. How many heathen children would it keep at school, at 48 cents each?

716. If a child is allowed to spend 1 cent a day, for sugar plums and the like, how many bibles would that send to the destitute annually?

717. How many children must make that saving, to support one orphan in the missionary family at Ceylon, at 12 dollars a year?

718. If a boy eats one pint of nuts a week, at 6 cents a quart, how many boys must deny themselves that indulgence, that the saving may support one orphan at Ceylon?

719. If a child eats 3 apples a day, at 6 cents a dozen, what is the amount in a year?

720. How many children must deny themselves this indulgence, to support a school for 50 heathen children?

721. If a family make use of 2 lb. of sweetmeats a week, worth 20 cents a lb., how much would they save in a year for doing good, by denying themselves this luxury?

722. How many tracts, of 12 pages each, would it pay for?

723. If 3 tea-spoonfuls of sugar a day be allowed for each person in the United States, according to the census of 1820, and the weight and cost is as stated in No. 708, how much might be saved every year for doing good, if all would deny themselves this indulgence?

724. How many missionaries would it support, at 500 dollars each?

725. How many bibles would it pay for, at 60 cents?

726. How many young men would it assist in obtaining an education, at 125 dollars each?

727. How many orphans would it support at Ceylon?

728. How many months of the year must the people of the United States drink their tea without sugar, that the saving may support one minister of the gospel for every 800 souls, at 600 dollars each per annum?

729. If a man drinks half a gill of ardent spirits a day, at 1 dollar a gallon, how many tracts, of 12 pages each, would the amount annually pay for?

730. If a man makes use of half a pint a day for himself and friends, how many bibles would that amount annually pay for?

731. How long must such a man abstain from that poison, that the saving may furnish him with a library of 100 volumes, at 1 dollar 50 cents a volume?

732. How long to pay for 100 acres of land, in the new settlements, at 2 dollars an acre?

733. How many such men, by abstaining from ardent spirits, could support a minister of the gospel, at $600 a year?

734. In the year 1810, the quantity of ardent spirits made and imported into the United States, over and above what was exported, was stated to be 33365529 gallons; how much is that for each person, according to the census of the same year? (See No. 408.)

735. What is the expense to each person, at 1 doll. a gal.?

736. Supposing this quantity annually consumed, how long must the people of the United States do without ardent spirits, that the saving may supply the whole world with bibles, allowing 1 bible to every 5 persons? (See No. 13.)

737. If one minister of the gospel should be allotted to every 800 souls, how much of the year must the people of the United States do without ardent spirits, that the saving may support them all, at $600 each per annum?

738. How many charity scholars would the expense of ardent spirits annually support, at $125 each per annum?

739. How many of our enterprising young men would that expense aanually furnish with farms of 100 acres each, at 2 dollars an acre?

740. How many persons would that expense annually sup-

ply with bread, allowing 5 bbls. of flour to every 6 persons, at 5 dolls. a bbl.?

741. How many more persons is that, than the whole population of the United States in 1810, by whom the ardent spirits were consumed?

742. If turnpike road can be made for 300 dollars a mile, how long must the people of the United States do without ardent spirits, that the saving may make a turnpike road that would reach round the globe?

743. How long, to make such a road from Boston to the mouth of the Columbia river, which is estimated to be 2800 miles?

744. How deep would the above quantity of ardent spirits fill a pond of ten acres?

745. How many acres would it cover a foot deep?

746. How many, an inch deep?

747. If it was put up in hhds. of 63 gals. each, how many would it fill?

748. How many waggons would it load, at 2 hhds. each?

749. How many miles would they reach, allowing 3 rods to each waggon and horses?

750. If the annual expense of ardent spirits to the people of the United States, is 33365529 dollars, how much is that per minute all the time, reckoning 365¼ days to a year?

751. What is the share of the state of New-York in that expense? (See No. 405.)

752. If the Great Erie Canal should be 360 miles long, and cost 12600 dollars a mile, how long must the people of the state of New-York do without ardent spirits, to defray the expense?

753. How long, to endow an academy in each of the counties in the state, (being then 45,) with a fund, that, at 7 per cent, shall yield 600 dollars a year forever?

754. How long, to endow each of the three colleges in the state with a fund for the support of indigent students, which will forever maintain 200 such students at each college, at 200 dollars each per annum?

755. How long, that the saving may furnish each of the towns in the state, (being then 452,) with a public library of 1000 volumes, at $1·50 a volume?

756. If the Western Education Society allow their beneficiaries 70 dollars a year each, and the people of the state of New-York should abstain from ardent spirits only half the

time, and pay the amount into the treasury of that Society, how many young men would it enable them to assist annually at that rate?

757. What is the share of the state of Vermont, in the annual expense of ardent spirits?

758. How long must the people of that state abstain from ardent spirits, that the saving may endow each of their two colleges with a fund, which, at 6 per cent, shall yield 5000 dollars a year forever?

759. How long, to endow an academy in each of the 13 counties of that state, with a fund, which, at 6 per cent, shall yield 600 dollars a year forever?

760. What is the share of the state of Connecticut?

761. How long must the people of that state abstain from ardent spirits, that the saving may support a minister of the gospel in each of the 219 parishes of that state, at 600 dolls. each per annum?

762. How long, to support a charity school in each of the 8 counties of that state, allowing 30 scholars to each school, at 200 dollars each, and the instructor 700 dollars a year?

763. How long, that the saving may furnish each parish with a public library of 1000 volumes, at $1.40 a volume?

764. How long, to furnish Yale College with a fund, which, at 6 per cent, will support 200 charity students, at $200 each per annum, forever?

765. How long, to furnish said College with a fund for the support of additional professors, which shall yield 5000 dolls. a year forever?

766. How long, to build a place of worship in each parish in the state, at 6000 dollars each?

767. If the grand list of that state is 5959756 dollars; how much on the dollar is the annual expense of ardent spirits?

768. How many miles would the share of Connecticut reach, at the rate stated in No. 749?

769. What is the share of the state of Massachusetts?

770. How many indigent students would it enable the American Education Society to assist, at 125 dollars each?

771. What is the share of New-England?

772. How many missionaries would it support, at 500 dollars each?

773. How many free schools would it support in India, at 24 dollars each?

774. How many heathen children would it keep at Christian schools continually, at 50 for each?

775. To how many heathen children would the saving of 20 years give a Christian education, allowing each child to remain at school 4 years?

776. How many ministers of the gospel would the saving for 24 years educate, allowing them to spend 8 years in their preparation, at 200 dollars each per annum?

777. If all the people in the state of New-York should contribute one cent a week, each, to the Western Education Society, how many young men would it enable them to assist, at the rate mentioned in No. 756?

778. If there should be a charity school established in each of the 8 counties of Connecticut, and the instructor of each should receive 700 dollars a year, and there should be 30 charity scholars at each school, at an expense of 150 dollars each a year, how much would be the expense per week to each person in the state?

779. If every person in Connecticut should contribute one cent a week, how many missionaries would it support, at 500 dollars each per annum?

780. If every person in Massachusetts should contribute one cent a week, how many orphans would it support in India, at 12 dollars each?

781. If every person in Vermont should contribute one cent a week, how many bibles would it pay for annually, at 60 cents each?

782. If every person in New-Hampshire should contribute one cent a week, how many tracts, of 12 pages each, would it pay for annually, at 1 mill a page?

783. If every person in the United States should contribute one cent a week, for doing good, how much would be thus raised annually?

784. How many missionaries would the half of it support, at 500 dollars a year each?

785. How many young men would the quarter of it assist in preparing for the ministry, at 125 dollars a year each?

786. How many bibles would the eighth of it pay for, at 60 cents each?

787. How many tracts, of 12 pages each, would the rest pay for, at 1 mill a page?

788. According to the reports made to the General Assembly of the Presbyterian Church in the United States, in

1819, the number of Presbyteries under their care, was as follows: Synod of Geneva, 6; Albany, 6; New-York and New-Jersey, 6; Philadelphia, 6; Pittsburgh, 6; Virginia, 4; Kentucky, 4; Ohio, 4; Tennessee, 5; North-Carolina, 3; South-Carolina and Georgia, 3: how many in all?

789. At the same time, the number of ordained ministers in the Synod of Geneva, and the number of congregations under their care, was as follows:

Presbytery of	*Min.*	*Cong.*	*Presbytery of*	*Min.*	*Cong.*
Niagara,	10	32	Geneva,	17	22
Ontario,	20	23	Cayuga,	19	28
Bath,	6	11	Onondaga,	21	29

How many ministers, and how many congregations?

790. In the Synod of Albany, as follows:

Albany,	16	22	Londonderry,	18	13
Columbia,	13	23	Champlain,	10	13
Oneida,	25	25	St. Lawrence,	12	4

How many ministers, and how many congregations?

791. In the Synod of N. York & N. Jersey, as follows:

Long-Island,	16	16	Jersey,	28	29
Hudson,	22	39	New-Brunswick,	16	16
New York,	13	22	Newton,	14	25

How many ministers, and how many congregations?

792. In the Synod of Philadelphia, as follows:

Philadelphia,	25	37	Carlisle,	29	36
New-Castle,	27	51	Huntingdon,	12	29
Baltimore,	16	12	Northumberland,	7	15

How many ministers, and how many congregations?

793. In the Synod of Pittsburgh, as follows:

Redstone,	19	23	Hartford,	9	25
Ohio,	28	48	Grand River,	6	16
Erie,	12	46	Portage,	7	20

How many ministers, and how many congregations?

794. In the Synod of Virginia, as follows:

Hanover,	15	26	Winchester,	13	15
Lexington,	16	30	Abington,	7	10

How many ministers, and how many congregations?

795. In the Synod of Kentucky, as follows:

Transylvania,	9	17	Muhlenberg,	5	22
West Lexington,	12	27	Louisville,	11	31

How many ministers, and how many congregations?

796. In the Synod of Ohio, as follows:

Washington,	9	26	Miami,	14	36
Lancaster,	15	34	Richland,	7	22

How many ministers, and how many congregations?

797. In the Synod of Tennessee, as follows:

Union,	9	16	*Mississippi,	5	8
West Tennessee,	6	16	Missouri,	4	
*Shiloh,	7	10			

How many ministers, and how many congregations

* Estimates.

798. In the Synod of North-Carolina, as follows:

Presbytery of	*Min.*	*Cong.*	*Presbytery of*	*Min.*	*Cong.*
Orange,	10	22	Concord,	16	68
Fayetteville,	11	32			

How many ministers, and how many congregations?

799. In the Synod of S. Carolina & Georgia, as follows:

Harmony,	19	28	Hopewell,	6	15
S. Carolina,	15	30			

How many ministers, and how many congregations?

800. Take the whole number of ministers, and the whole number of congregations in the preceding eleven questions, and add 104 licensed preachers, not ordained; and tell the whole number of authorised preachers, and of congregations, in connection with the General Assembly, in the year 1819.

801. If the whole number of communicants in all the churches in the United States, should be equally divided into 8 classes, how many would be in each class?

802. If the first class, comprising the most wealthy in our large towns, should contribute each 50 dolls. a year for charitable purposes, what would be the annual amount?

803. If the second class, comprising the most wealthy in the country villages, give each 30 dollars, what would be the amount?

804. If the third class, comprising those less wealthy, give each 10 dollars, what would be the amount?

805. If the fourth class, comprising farmers, mechanics, &c. give each 5 dollars, what would be the amount?

806. If the fifth class, comprising young men, give each 3 dollars, what would be the amount?

807. If the sixth class, comprising young women, give each 2 dollars, what would be the amount?

808. If the seventh class, comprising the poorer sort, who enjoy health, and can labor, give each one dollar, what would be the amount?

809. If the eighth class, comprising the aged, the infirm, the feeble, &c. give each 25 cents, what would be the amount?

810. What would be the whole amount annually contributed by these eight classes?

811. If they should all continue their contributions for 10 years, what would be the amount?

812. If this was made a permanent fund, what annual interest would it yield, at 6 per cent?

813. If half that interest should be applied to the education of young men for the gospel ministry, how many would it assist, at $125 each?

814. If the other half should be applied to the support of missionaries, how many would it maintain, at $500 each?

815. In 1817, the receipts of the British National School Society for educating the poor, on the Lancasterian system, had been, for 6 years, 38250*l.* sterling; how much is that in federal money?

816. The number of children in their schools in that year, was 155000; if one fourth of the above sum was expended in their education in that year, how much is that for each child?

817. It is estimated, that there are 64 millions of children in the world at a time, who ought to be at school; and if each child can be schooled, on the British system, at 30 cents a year, what would it cost for the whole?

818. What, for 22 years?

819. If 5 persons are allowed to a family, how many families are there in the whole world? (See No. 13.)

820. If 5 millions of families are already supplied with bibles, and a bible costs 60 cents, how much would it cost to supply the rest of the world with one to a family?

821. If a preparation of 8 years, at an expense of 200 dollars a year, is necessary for a missionary; what is the whole amount?

822. If one missionary is wanted for every 3000 of those who are not nominal Christians, what would it cost to educate the requisite number? (See Nos. 13 and 14.)

823. If it should cost as much to convey each one to his station, as the passage from America to India, which is 250 dollars; what would it cost to convey the whole number to their stations?

824. What would it cost to maintain the whole, 22 years at 500 dollars a year each?

825. If 40000 additional ministers are wanted to supply the destitute in Christian countries, what would it cost to educate them, and support them 22 years, at the above rates?

826. What would it cost to school all the children in the world, for 22 years; to supply the whole world with bibles; and to educate and support for 22 years, a supply of ministers and missionaries for all the destitute in the world?

827. During the war consequent upon the French revolution, from 1793 to 1815, a period of 22 years, the war expense of Great Britain is calculated to have been 3200 millions of dolls.; France, 3130 millions; Austria, 1000 millions; U.

States, (3 years,) 120 millions; other powers of Europe, estimated at 4550 millions: what was the whole expense of that war to the nominally Christian world?

828. If they had been willing to expend one third as much to inform, moralize, and christianize the world, how much more than sufficient would that sum have been, to accomplish all these objects, during the same period, according to the preceding statements?

829. If, instead of an appeal to arms, the nations had established a general congress of all the Christian powers, for the settlement of all difficulties between nations; and the above surplus had defrayed its expenses for the same period, how much would it have been for each year?

830. In the preceding estimate of the expense of a single war, it is probable that nothing is included but the sums actually paid out by the respective governments; and that the loss of productive labor, the loss of lives, and the destruction of private property, are omitted. The military war establishment of Europe is stated at 3908000 men. Suppose only 2 millions were actually under arms during those 22 years, and 2 millions more were employed in preparing and conveying arms and stores; what is the loss of productive labor, reckoning these men to have been able to earn only 30 cents a day, at some useful employment, excluding the Sabbaths, and including the additional days for leap years?

831. If the number of lives lost in the first seven years of that war, was in the same proportion as in the last 15, (see No. 696,) how many lives were lost in all?

832. If the pecuniary loss to the public, from the death of an able bodied man, is $1500; what is the amount of this item of loss by that war?

833. What is the total amount of the loss of labor and the loss of lives?

834. Among the numerous idolatrous festivals of the Hindoos, it is computed, that the annual expense of one to the inhabitants of Calcutta, is 500000*l.* sterling; what would it be to the whole of Hindoostan, at the same rate? (See No. 604, 607.)

835. How many missionaries would it support, at 113*l.* each?

836. If the whole population of Hindoostan were divided among them, how many souls would it be to each?

837. What was the solid content, in feet, of Noah's ark, being 300 cubits long, 50 wide, and 30 high?

838. It is stated by the learned, that there are about 150 kinds of quadrupeds, 200 kinds of birds, and 40 kinds of reptiles, that must have been preserved in the ark. Suppose there were 200 kinds of quadrupeds, of which 20 were clean; 300 kinds of birds, of which 20 were clean; and 50 kinds of reptiles; and that 7 of every kind of clean animals, and 2 of every kind of unclean ones, and 8 persons, were preserved; how many living creatures would there be?

839. Suppose the quadrupeds to average the size of a two year old steer, and to require stalls that should give each 8 feet in length, 5 in width, and 6 in height; the birds to average the size of a hen, and to require lofts that should give each 2 cubic feet of room; and the reptiles to have 1 cubic foot each: how many cubic feet would all these animals occupy?

840. Allow Noah and his family, 1 kitchen, 20 ft. long, 20 wide, and 10 high; 1 parlor, and 1 store-room for provisions, of the same dimensions; and 4 lodging rooms, each 10 ft. long, 10 wide, & 10 high; how many cubic feet would they occupy?

841. If one third of the unclean beasts and one fourth of the unclean birds were carnivorous, and 2 sheep a day were allowed for 6 beasts and 7 birds, and each sheep required 52 cubic feet of room; how many cubic feet would be occupied by the sheep necessary in a year?

842. If each of these sheep was allowed a quart of grain a day, and an equal quantity of water, till it was killed, how many cubic feet would be necessary to store that grain and water?

843. If each of the rest of the beasts was allowed a peck of grain, and an equal quantity of water per day; and each of the rest of the birds, one eighth of a quart of grain, and an equal quantity of water per day; how many cubic feet would be necessary to store that grain and water?

844. If each of the sheep kept for food was allowed $\frac{1}{4}$ of a cubic foot of pressed hay per day, till it was killed; and each of the other beasts not carnivorous, was allowed 2 cubic feet per day, through the year; how many solid feet would be necessary to store that hay?

845. Allow Noah's family to use 50 gals. ale measure, water per day; how many cubic feet would be necessary to store it?

846. Allow Noah 3 rooms, each 20 ft. long, 20 wide, and 10 high, to store farming utensils, and other necessary articles; how many cubic feet would they occupy?

847. Allow 10 ft. wide, at one end of the ark, the whole breadth and height, for stair cases; and 10 feet wide through the whole remaining length, and the whole height, for passages; and how many cubic feet would be occupied by these?

848. Add the preceding nine items together, and how many cubic feet would be left for the thickness of the walls, floors, partitions, and other purposes?

849. The contributions to the funds of the American Board for Foreign Missions, for the year ending Aug. 31, 1821, were as follows: From Massachusetts, 19820·66 dolls.; Connecticut, 7874·08; New-York, 6424·96; Vermont, 1912·96: N. Hampshire, 1699·40; Maine, 1429·76; N. Jersey, 1384·74; Pennsylvania, 1312·99; Georgia, 1052·36; Ohio, 506·10; S. Carolina, 495·06; Virginia, 400·62; Maryland, 393·50; Kentucky, 369·31; N. Carolina, 251·30; Rhode Island, 65·56; Tennessee, 63·00; Delaware, 36·00; Michigan, 26·75; Columbia Dist. 15·00; Indiana, 8·43; Choctaw Nation, 74·25; Cherokee Nation, 31·00; Switzerland, 212 00; England, 40·00; S. America, 3·00; West Indies, 3·00; places unknown, 491·89: how much in all?

850. How much less than half the whole, was contributed by Massachusetts?

851. How much more than half the whole, by Massachusetts and Connecticut?

852. How much is the amount contributed by Massachusetts, for each person in the state? (See No. 404.)

853. How much is the amount contributed by Connecticut, for each person in the state?

854. If New-York had contributed in the same proportion as Massachusetts, what sum would have been raised in that state?

855. If all the states had contributed in the same proportion as Massachusetts, what sum would have been raised in the whole?

856. If the extra expense of the thanksgiving dinner, to the inhabitants of New-England, reckoning time and money, is 30 cents each person; and if they should satisfy themselves with a common dinner on that day, and testify their gratitude to God by devoting that amount to his service; how much would be thus raised annually?

857. If all the people of the United States should content themselves with a dinner, once a week, that should cost one cent less than ordinary, for each person, and should pay that amount into the treasury of the Lord; how much would be thus raised annually?

858. Take the receipts of the principal charitable societies in England, as stated in No. 54, and suppose all the other charitable societies in Europe to do as much as the British and Foreign Bible Society, and what is the annual amount, in federal money, contributed in Europe for spreading the gospel?

859. During the year ending in 1821, the American Bible Society received 49578 dolls.; the American Board for Foreign Missions, 46398 dolls.; the Baptist Board for Foreign Missions, 18000 dolls.; the United Foreign Mission Society, 15263 dolls.; the American Education Society, 13109 dolls.; and 30 smaller societies, about 60388 dolls. Add 60000 dolls. more, for all other societies; and what is the annual amount contributed in the United States for spreading the gospel?

860. How long would the people of the United States need to abstain from ardent spirits, to save that amount, supposing the same quantity to be consumed now, that was in 1810? (See No. 734.)

861. How long, to save as much as is contributed in both Europe and America?

862. Nearly all the societies in the world for the spread of the gospel, have been formed within 30 years, and most of them within half that period. It is calculated, partly from documents, and partly from estimates, that the following sums have been raised for that purpose, by the principal societies in England, during that period, to wit: By the British and Foreign Bible Society, 4036658 dolls.; by 13 others, 7704222. Suppose all the other societies in Europe to have done as much as the B. & F. Bible Society; and what is the whole amount which has been raised in Europe for the spread of the gospel, within the last 30 years?

863. What is the average amount per year?

864. It is thought, that if we allow to the American Societies an average income for 20 years, which shall bear the same proportion to their present income, that the above stated average income of the European Societies bears to their present income, it will equal the whole amount of what

has been done in the United States for the spread of the gospel in 30 years. If so, what is the amount?

865. What is the whole amount of what has been done for that object, in Europe and America, during 30 years?

866. How long would the people of the United States need to do without ardent spirits, to save that amount? (See No. 734.)

867. It is computed, that 200 bushels of potatoes, or something equivalent, can be raised in a missionary field, by labor equal to 36 days' work. If this is so, and one person in 4 of the whole population of the United States should labor 3 days every season for that purpose, and the potatoes should sell for 5 sixteenths of a dollar per bushel; what amount would be thus raised annually?

868. If one person in ten of the whole population of the United States, sleeps an hour later every morning than is necessary, and his labor is worth 8 cents an hour; what annual amount is thus lost, which might be saved for doing good, reckoning 313 working days?

869. If a youth can read an octavo page in 2 minutes, and is in the habit of spending 3 hours each evening in idleness, from the first of November to the first of March in each year; how many volumes, of 300 pages each, could he read, in his winter evenings for 10 years?

870. In the year 1821, it was supposed there were 2500 dram shops kept in the city of New-York. If the rent of each of these is 70 dolls., and the labor of one man to attend each, is worth 200 dolls; what is the amount of these two items of the expense of these public nuisances?

871. If each of these shops sells liquor to the amount of only 2 dolls. per day, what is the annual amount?

872. In 1820, there was stated to be 8000 paupers in the city of New-York. If the expense of supporting them averages 1 doll. per week, what is the annual amount?

873. It is believed, that three fourths of the expense of supporting paupers is occasioned, directly or indirectly, by intemperance. Take $\frac{3}{4}$ of the last amount, and add to the two preceding, and tell the total.

874. During the same year, the amount expended for public and private schools, was $14759·41; and there were 63 ministers of the gospel employed in the city. If these had a salary of $1500 each, what amount was expended for religious and literary instruction?

875. By a report made to the legislature of Massachusetts in 1821, it appeared, that the number of paupers in that state was about one sixty-sixth of the whole population; and that the average expense of supporting them was one dollar per week. If it is the same in all the other states, and three fourths of the expense is occasioned by intemperance, what amount would be annually saved in this way, by the disuse of ardent spirits?

876. In 1812, Mr. H. Campbell estimated the poor rates in England and Wales, at 16452656*l.* sterling, and the number of paupers at 2079432; what is that, in federal money, for each pauper?

877. In 1820, it was stated that there were 14000 paupers in Liverpool, supported by parish rates paid by 20000 individuals; if each pauper cost as stated in the last question, what had these individuals to pay on an average?

878. The Connecticut Missionary Society paid for missionary services, in 1816, $5466·38, of which $452·61 were for services rendered in Kentucky, $1328·38 in New-York, $615·85 in Missouri, $5·11 in the southern part of Ohio, $394·93 in Pennsylvania, $367 in Tennessee, $294·28 in Vermont, $150 in Indiana, and the rest in New Connecticut; how much was the last?

879. In 1730, the number of graduates at Yale College for 29 years, had been 235, of which 118 became ministers of the gospel; how many ministers does that average yearly?

880. How many did not become ministers, to one that did?

881. In the next 20 years, to 1750, there were 385 graduates, of which 162 became ministers; how many ministers yearly?

882. How many did not become ministers to one that did?

883. In the next 20 years, to 1770, there were 648 graduates, of which 201 became ministers; how many ministers yearly?

884. How many did not become ministers, to one that did?

885. In the next 20 years, to 1790, there were 723 graduates, of which 177 became ministers; how many ministers yearly?

886. How many did not become ministers, to one that did?

887. In the next 20 years, to 1810, there were 790 graduates, of which 160 became ministers; how many ministers yearly?

888. How many did not become ministers, to one that did?

889. In 1767, the graduates at Princeton College for 20

years, had been 291, of which 180 became ministers; how many ministers yearly?

890. How many did not become ministers, to one that did?

891. In 1807, the graduates for 20 years had been 525, of which 50 became ministers; how many ministers yearly?

892. How many did not become ministers, to one that did?

893. Harvard University, from 1719 to 1741, furnished an average of 13 ministers annually; how many in the whole in that time?

894. From 1800 to 1810, only 6 annually; how many in that time?

895. Dartmouth College, from 1780 to 1800, furnished an average of 8 ministers annually; how many in that time?

896. From 1800 to 1810, only 5 annually; how many in that time?

897. The proportion of graduates at the principal colleges, who entered the ministry, from 1800 to 1810, was one sixth; and Harvard, Yale, Union, and Princeton, together, sent out about 200 graduates a year; how many ministers did they furnish in that time?

898. If all the other colleges in the United States furnished as many more; what is the whole in those 10 years?

899. If the number of educated ministers in the United States, in 1820, was 2390: and there should be 500 graduates annually at the colleges, of which one sixth should become ministers, and half as many more should obtain a sufficient education without going to college, and none should die; how many would there be in the year 1843?

900. But if the life of a minister averages 25 years after entering the ministry, only 2 twenty-fifths of the old ones, and about 16½ twenty-fifths of the new ones, will then be alive; how many will that be?

901. If the population of the United States should double in 23 years, and one minister is necessary for every 800 souls, how many would then be destitute of an educated ministry?

902. In the next 23 years, let 800 be graduated annually, and one fifth of them enter the ministry, and half as many more without going to college; how many ministers would there be then, after deducting the deaths as above?

903. If the population doubles again, how many will be destitute in the year 1866?

904. In the next 23 years, let 1000 be graduated annually, and one fifth of them enter the ministry, and half as many

more without going to college; how many ministers would there be then, after deducting the deaths as above?

905. If the population doubles again, how many will be destitute in the year 1889?

906. If the whole number of Protestants is 60 millions, and only 50000 missionaries are wanted to send to the heathen, and if the number of Protestants in the United States is 9375000, how many ought they to furnish?

907. The donations to the Massachusetts Missionary Society, for 1820, were $2371·57, of which $1341·33 was for the permanent fund; how much, in N. England currency, was for current expenses?

908. The expenditures of the Massachusetts Christian Knowledge Society, for 1820, were $1456·33; in 1816 they were $2622·33; how many guilders was the decrease?

909. The receipts of the London Jews' Society, in 1817, were £10091 sterling; how many rials of plate is that?

910. The Vermont Bible Soc. received, in 1814, $1462·13; how many English guineas is that?

911. The Connecticut Education Society, in 1817, received $1370·43; how many millrees is that?

912. The Female Education Society of New-Haven, received $351·18; how many rupees is that?

913. The Connecticut Domestic Missionary Society received $1263·63; how many rubles is that?

914. The permanent fund of the Connecticut Missionary Society, was $31583·65; how many Hebrew shekels of silver is the annual interest at 6 per cent?

915. The Philadelphia Education Society, in 1820, received $2039·80; how many Greek oboli is that?

916. In 1819, the Female Missionary Society of the Western District of N. York, received $1352·38: how many Roman sestertii is that?

917. In 1820, the General Assembly of the Presbyterian Church appropriated for their Theological Seminary, $4752·05½, of which were expended as follows: Salaries and house rent of 2 professors, $4000; half year's salary of assistant teacher of languages, $200; printing, stationary, &c. $40·07½; travelling expenses of one director, $21; treasurer's commissions on the above, $42·61: how many drachmæ of silver in what was unexpended?

918. In 1818, the Western Education Society received $2028·67, and expended $1531·53; how many Hebrew shekels of gold in the difference?

919. In 1819, the N. York Religious Tract Society received $849·95; how many Greek staters of silver is that?

920. In 1819, the collections for the Theological Seminary of the Dutch Reformed Church, were $3730·04; how many Roman denarii is that?

921. The funds of their General Synod were as follows: Van Bunschooten fund, $14750; professoral fund, $12052·57; permanent fund, $9133·05: how many Hebrew minæ of silver is that?

922. How many drachmæ of gold is the annual interest at 7 per cent?

923. One of their theological professors has $1750 a year, and the other $1550; how many Roman asses in the whole?

924. In 1821, the Board of Missions of the General Assembly appointed missionaries to labor in the destitute settlements, 168 weeks; how many Attic minæ of silver would that amount to at $9 a week?

925. The collections reported for missionary purposes, amounted to $2135·51; how many weeks labor would that pay for, at $9 a week?

926. The collections reported for the Commissioners' fund, were $1415·24; how many miles travel would that pay for, at $5\frac{1}{2}$ cents per mile?

927. In 1821, the permanent fund of the American Education Society was $6878·50; how many rials of vellon in the annual interest at 6 per cent?

928. In 1821, the receipts of the Young Men's Missionary Society of N. York, were $2375·77; how many pagodas is that?

929. In 1813, the receipts of the Hampshire Miss. Soc. were $1527·25; how many sequins is that?

930. The Leeds and Liverpool canal is 129 miles long, and cost 800,000*l.* sterling; what is that per mile?

931. The canal of Languedoc is 180 miles long, and cost *L*540000; what is that per mile?

932. The Middlesex canal, in Massachusetts, is 28 miles long, and cost 478000 dolls.; what is that per mile?

933. The Erie canal, in New York, is expected to be 363 miles long, and to cost 4571814 dolls.; what will that be per mile?

934. If one million of tons should pass through it annually, and the toll should be a cent and a half per ton per mile, what will be the amount?

935. If only half that amount be produced, and $500000 be annually required for repairs, officers, &c.; what will be the annual net proceeds to the state?

936. If the whole expense should be at simple interest at 7 per cent, three years before the canal is opened, and one year more before a year's toll can be applied to pay it, and the net proceeds be applied, at the end of every year, to extinguish the debt; how much will remain to the state at the end of the third year after the canal is opened?

937. If 500000 tons pass through the canal annually, and the transportation by land was 90 dolls. per ton, and on the canal is $4·55½, and the toll is as stated above; what is the annual saving to the public?

938. If the toll and transportation together are 2 and a half cents per mile, and a million of tons should be annually transported on the canal; what would be the annual saving to the public, on every mile the canal should be shortened?

939. It is estimated, that if the canal could be made directly from Schenectady to Albany, instead of going round by the Cohoes, the distance would be shortened 14 miles, and other advantages gained equal to a saving of 5 miles more; if so, what would be the annual saving to the public, on toll and transportation alone; and what capital would this be equivalent to, on the principle of perpetuities, discounting at 5 per cent compound interest?

940. If the width of the canal is 28 feet at the bottom, and 40 feet at the top of the water, and the water is 4 feet deep; how many cubic feet of water are in every foot in length?

941. In 1816, the permanent annual expenses of the government of the United States, were estimated, by the Secretary of the Treasury, to be 23500000 dolls.; of which, 1765513 dolls. were civil, diplomatic, and miscellaneous; 6459626 dolls. were military; 3986659 dolls. were naval; 283202 dolls. were incidental; and the rest to pay the interest, and reduce the principal of the public debt: how much is the last?

942. It is estimated, that the annual expense of militia trainings in the United States, is 5 millions of dollars. Add that to the military and naval expenses of the government, as above stated, and tell the amount.

943. If that amount should be appropriated to spread the gospel of peace, how many bibles would one eighth of it annually furnish, at 60 cents each?

944. How many missionaries would one fourth of it support, at 500 dolls. each?

945. How many young men would one eighth of it assist in their education for the ministry, at 125 dolls. each?

946. How many tracts, of 12 pages each, would one sixteenth of it annually furnish, at one mill per page?

947. How many children would the rest of it keep at school, at the rate mentioned in No. 817?

948. Congress reserved of the public lands in Alabama, 46000 acres for a university, which is estimated at 15 dolls. per acre; if it should be sold for that, and the money placed in a fund which yields 6 per cent, what will be the yearly amount?

949. The representation in Congress, according to the sensus of 1820, is to be as follows: New-York, 34 representatives; Pennsylvania, 26; Ohio, 14; Massachusetts, 13; Maine, 7; Connecticut, 6; New-Jersey, 6; New-Hampshire, 6; Vermont, 5; Indiana, 3; Rhode-Island, 2; Delaware, 1; Illinois, 1: how many in the Northern states?

950. In the Southern states, Virginia, 22; North-Carolina, 13; Kentucky, 12; Tennessee, 9; South-Carolina, 9; Maryland, 9; Georgia, 7; Louisiana, 3; Alabama, 3; Missouri, 1; Mississippi, 1: how many in these?

951. How many in all?

952. The value of domestic articles exported from the United States in the year 1819, was as follows: Produce of the sea, $2024000; of the forest, $4927000; of agriculture, $41452000; manufactures, $2574000; uncertain, $630000; how much in all?

953. The value of foreign articles exported, was 18008029 dollars; what is the total value of exports in that year?

954. If one per cent of this was devoted to charitable purposes, how many livres would it be?

955. The mean temperature of Boston in 1819, according to observations made three times a day, was as follows: January, 30 degrees of Fahrenheit's thermometer; February, 31; March, 29; April, 41; May, 52; June, 67; July, 71; August, 69; September, 64; October, 53; November, 40; December, 31: what was the mean temperature of the whole year?

956. The number of inches of rain which fell, was as follows: January, 1·05; February, 2·27; March, 6·51; April, 3·74; May, 3·06; June, 3·56; July, 2·02; August, 4·38;

September, 5·27 ; October, 1·40 ; November, 1·22 ; December, 1·29 : how many inches in the year ?

957. From July 1816 to June 1817, the mean degrees of heat at Bombay, were as follows : July, 80 ; August, 78¼ ; September, 79¼ ; October, 83½ ; November, 82½ ; December, 79¼ ; January, 78¾ ; February, 76½ ; March, 79 ; April, 83½ ; May, 85½ ; June, 82¼ : what was the mean heat of the whole year ?

958. The population of Massachusetts in 1820, was stated as follows ?

	males.	*females.*
Whites, under ten years old,	70993	69265
from ten to sixteen,	38573	38303
from 16 to twenty-six,	49506	52805
from 26 to forty five,	54414	57721
from 45 upwards,	38668	46171
Blacks,	3308	3560

What is the whole number, and how many more females than males ?

959. In 1819, the number of revolutionary pensioners was stated as follows : In N. Hampshire, 1142 ; Maine, 1824 ; Massachusetts, 2514 ; R. Island, 249 ; Connecticut, 1373 ; Vermont, 1296 : how many in New England ?

960. In N. York, 3196 ; N. Jersey, 467 ; Pennsylvania, 1090 ; Delaware, 41 ; Maryland, 575 ; Dist. of Columbia, 51 : how many in the Middle states ?

961. In Virginia, 693 ; N. Carolina, 212 ; S. Carolina, 180 ; Georgia, 45 ; Alabama, 5 ; Mississippi, 6 ; Louisiana, 1 : how many in the Southern states ?

962. In Kentucky, 474 ; Tennessee, 114 ; Ohio, 647 ; Indiana, 96 ; Illinois, 4 ; Missouri, 6 ; Michigan, 3 : how many in the Western states ?

963. How many in all the states ?

964. What would be the amount of pensions, at 8 dollars a month each ?

965. The amount of the funded debt of Great Britain and Ireland in 1812, was £906939589 .. 16 .. 8, and unfunded, £56397843 .. 16 .. 10 ; what is the whole in federal money ?

966. What was the value of the golden candlestick and its appendages, being a talent of gold ?

967. What was the whole value of the gold and silver of the tabernacle, being 29 talents, 730 shekels of gold, and 100 talents, 1775 shekels of silver ?

968. What was the value of a chariot from Egypt, in Solomon's time, being 600 shekels of silver?

969. What, of a horse, being 150 shekels of silver?

970. If the price of redemption of a field sown with a homer of barley, was 50 shekels of silver, (Lev. 27. 16,) what was that, in federal money, for the ground sown with a bushel?

971. How many quarts, dry measure, was the allowance of manna for each person, being an omer?

972. How many gallons of wine did our Lord make by his miracle at Cana, if each of the 6 water pots contained $2\frac{1}{2}$ baths?

973. What was the value, in federal money, of the ointment which Mary poured on the feet of Jesus, being 300 Roman pence, or denarii?

974. How long is the side of a cube of fine gold, which weighs a ton?

975. What is the solid content of 2 Cwt. of steel?

976. If the diameter of the Earth is 7928 miles, and that of the Sun, 883248; how many times larger than the Earth is the Sun?

977. How many wine gallons in 10 Cwt. of proof spirits?

978. How many solid inches in a living man who weighs 170 lb. avoirdupois?

979. A and B travel the same way, as follows: A, 55 miles, 6 furlongs, 27 poles; 36 m.; 27 m. 28 p.; 29 m. 3 fur.: B, 36 m. 3 fur. 29 p; 27 m.; 28 m. 27 p.; 34 m. 7 fur.: and then A travels back 22 m. 3 fur. 17 p.; 24 m. 6 fur.: how far asunder are they?

980. There are two numbers, the less is 8967, and their difference three times as many; what is the greater number?

981. There are two numbers, the greater of which is 79 times 209, and their difference 26 times 29; what is their sum?

982. An apothecary mixed 5 sorts of medicines, each 3 lb. 11 oz. 7 dr. 2 sc. 13 gr.; and 7 sorts, each 11 oz. 5 dr. 1 sc. 12 gr.; how much in all?

983. What is the amount of twice twenty five added to twice five and twenty?

984. Bought of A, 37 gal. 3 qt. of wine; of B, three times as much, and 5 gal. 2 qt. more; of C, as much as of A and B both, and 7 gal. 3 qt. 1 pt. more: sold D, 7 gal. 1 pt.; E, 5 gal.; F, as much as the difference between D and E, and 2 gal. 1 qt. more; how much is unsold?

985. Add 333 eagles, 333 dolls. 333 dimes, 333 cents, and 333 mills, together.

986. How many lb. Troy, in $\frac{5}{6}$ of $\frac{2}{3}$ of $\frac{1}{2}$ of $\frac{4}{5}$ of $\frac{6}{7}$ of $\frac{3}{4}$ of 2800 lb. avoirdupois?

987. What day of the year was the last day of June 1816?

988. By what must £130 .. 8 .. $6\frac{1}{2}$ be divided, to give a quotient of £6 .. 17 .. $3\frac{1}{2}$?

989. If a debtor who owes *L*2000, pays but £625, how much is that on the pound?

990. Tell the product of $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{2}{3}$ of $\frac{1}{5}$ of 1500, by $\frac{2}{3}$ of $\frac{1}{15}$ of 90.

991. From 9 lb. 7 oz. 10 dwt. of silver, how many spoons can be made, each weighing 2 oz. 15 dwt.?

992. How many solid feet in a ton of cork?

993. Bought two parcels of flour, which together weighed 19 Cwt. 3 qr. 4 lb., for £97 .. 17 .. 6; their difference in weight was 3 Cwt. 1 qr. 4 lb.. and in price, £8 .. 13 .. 6; what was the weight and value of the greater parcel?

994. Received £20000, and paid 16 persons £54 .. 10 .. 6 each, and 3 persons £193 .. 6 .. 4 each; what is $\frac{1}{3}$ of the rest?

995. A was born August 6, 1783, and B, Oct. 21, 1815; how old will A be when B comes of age?

996. There are two numbers, of which the greater is 76 times 111, and their difference is 18 times 27; what is their product?

997. From 19 chests of tea, each 3 Cwt. 2 qr. 7 lb., how many canisters of 7 lb. each can be filled?

998. Sent to the bank $9\frac{1}{2}$ eagles, $9\frac{1}{2}$ dolls. $9\frac{1}{2}$ dimes, and $9\frac{1}{2}$ cents; and drew checks for $36·25, $27·27, and $19·34; how much is left?

999. One planet has moved through 9 signs, 29 degrees, 29 minutes, 25 seconds of its orbit; and another has moved 5 signs, 15 degrees, 18 minutes, 3 seconds, less than the first; how much does the latter want of a complete revolution?

1000. If a wheel is 9 feet 2 inches in circumference, how many times will it turn round in running 150 miles?

1001. How many dozens of gallon, quart, and pint bottles, of each an equal number, may be filled from a cask of wine containing 231 gallons?

1002. Bought 125 Cwt. 2 qr. gross of sugar, tare 176 lb., trett 4 lb. per 104 lb; how many lbs. neat?

1003. How much did I gain, if I sold it for $3\frac{1}{2}$d. per lb. more than I gave for it?

1004. If 2345 cost £236 .. 18 .. 6, what cost 1565 ?

1005. What sum, at interest for 9 years and 6 months, will amount to *L*428 .. 5, if the rate per cent is 4½ ?

1006. How long is the side of a cube of marble, which weighs a ton ?

1007. D has linen worth 20d. an ell, ready money; but in barter he would have 2s. E has cloth worth 14s. 6d. per yd. ready money; at what price ought it to be rated in barter ?

1008. A man left his son £1500, to receive the amount at 5 per cent, when he should come of age, which was then found to be *L*2193 .. 15; how old was the boy when the bequest was made ?

1009. If a man can travel 300 miles in 18 days, when the days are 14 hours long; in how many days can he travel 950 miles, when the days are but 12 hours long ?

1010. Divide 360 into 4 parts which shall have the ratio of 3, 4, 5, and 6.

1011. A owes B a sum of money, of which ½ is payable in 2 months, ⅛ in 4 months, ⅛ in 6 months, and ¼ in 8 months; what is the equated time ?

1012. Tell the amount of *L*50, at compound interest, for 5 years, at 5 per cent, the interest payable half yearly ?

1013. Tell the amount, if payable quarterly ?

1014. A, B, and C, trade together. A at first put in 480 dolls. for 8 months, and then put in 200 dolls. more, and continued the whole 8 months longer, and then took out his whole stock. B put in 800 dolls. for 9 months, and then took out D583·333, and continued the rest 3 months longer. C put in D366·666 for 10 months, then put in D250 more, and continued the whole 6 months longer. At the end of their partnership, they had cleared D1000; what is each man's share ?

1015. How many ale gallons in 1 Cwt. of cow's milk ?

1016. What cost 648 A. 2 R. 36 p. at £2 .. 19 .. 11½ per acre ?

1017. If my income is 500 English guineas a year, and I spend 18s. N. England currency, a day; in what time shall I save 3715 dollars ?

1018. How many yds. of matting, that is ½ yd. wide, will cover a floor that is 12 feet by 28 ?

1019. Suppose 1000 men in garrison, with provisions sufficient for 3 months; how many must depart, that the provisions may last 15 months ?

1020. A certain cistern has 5 pipes; by the first alone, it can be filled in 12 minutes, by the second in 15, by the third in 20, by the fourth in 30, and by the fifth in 60; in what time will all running together fill it?

1021. What is the weight of a hhd. of rain water?

1022. If the earth moves round the sun, 596900000 miles, in 335¼ days, how far are we carried per second by this motion?

1023. How far are those who live under the equator, carried per hour, by the diurnal motion of the earth?

1024. If sound flies 1142 feet per second, and light is seen instantaneously; and if a person's pulse beats 70 times a minute, how far distant is the explosion of a clap of thunder, when you count 8 pulsations between seeing the flash and hearing the report?

1025. How much in length, that is 24 poles wide, will make 2 acres?

1026. Received from Jamaica, 28 hhds. sugar, each 12 Cwt. 1 qr. 10 lb., their Cwt. being 100 lb.; how many of our Cwt. are in the whole?

1027. Bought a parcel of cloth, at the rate of 12s. 8d. for every 2 yds.; and sold a quantity at the rate of 45s. 10d. for every 3 yds., by which as much was gained as 150 yds. cost; how much was sold?

1028. Lent 250 dolls., and at the end of 8 months received 260; at what rate was the interest computed?

1029. If a staff 4 ft. 6 in. long, standing erect, casts a shadow, at 12 o'clock, 7 ft. 4 in.; how wide is a ditch, running due east and west, at the north side of a wall, which is 71 ft. high, and stands 21 ft. from the ditch, and the shadow of the wall, at 12 o'clock, reaches 13 ft. 8 in. beyond the ditch?

1030. If 4 ells Flemish cost *L*1 .. 6 .. 8, what must be paid for 10 pieces, each containing 21 ells English?

1031. If 68 gallons of water fall into a cistern per hour, and 24 run out, and the cistern contains 4 hhds.; in what time will it be filled?

1032. In the year 1768, the parish of S. F. in the state of Connecticut, gave a call to a minister of the gospel, and offered him 175*l.* settlement, and 70*l.* a year salary, N. Eng. currency; and stated the price of wheat at 4s. a bushel, rye 2s. 8d., and corn 2s. How many dolls. salary would be equal to that, when wheat is 12s. a bushel, rye 6s., and corn 3s. 6d., the salary being increased by the amount of the set-

tlement, on the principle of annuities, discounting at 5 per cent, compound interest, and reckoning 25 years the life of a minister?

1033. A man has two sons, A and B. At the age of 14, he tells them that he will give them 2000 dolls. each, and allow them to choose their profession. A chooses to have a liberal education, and be a minister of the gospel. B chooses to be a blacksmith. A's money is put out at interest, at 6 per cent; and he draws upon it, from year to year, to defray the expense of his education; in obtaining which, he spends 8 years, and exhausts his fund. B's money is put out at interest, at the same rate; but having no occasion to draw upon it, the interest is every year added to the principal. At the age of 22, they both settle in the same parish; A as their minister, B as their blacksmith. The people support A, so that he provides comfortably for himself and family, and lays up 50 dolls. every year. By industry in his business, B supports himself and family equally well, and lays up the same sum. At the end of 42 years from their settlement, they die, leaving to their families the same amount of property saved from their earnings. But in addition to this, B has his 2000 dolls. with its compound interest since he was 14 years old, which A might have had also if he had chosen the same profession. How much has A relinquished, and really given to his parish, for the privilege of being their minister, which he might have saved to himself, if he had been their blacksmith?

1034. Tell the interest of 273¾*l.* for one year, at 3¼ per cent.

1035. There are two numbers, the sum of which is 90, and their product is ·000; what are the numbers?

1036. How many men should reap 417·6 acres in 12 days, when 5 men reap ⅓ of that quantity in ½ the time?

1037. If a cellar 22·5 feet long, 17·3 wide, and 10·25 deep, is dug in 2½ days, by 12 men, working 12·3 hours a day; how many days of 8·2 hours, should 18 men take to dig one 45 feet long, 34·6 wide, and 12·3 deep?

1038. How wide is a street, when two ladders, each 30 feet long, placed foot to foot, reach, one to a window 16 feet high on one side of the street, and the other to a window 20 feet high on the other side?

1039. In 600*l.* Canada, how much S. Carolina?

1040. How much in length, of a piece of land that is 11½½ poles wide, will make an acre?

1041. Reduce $\frac{2}{7}$ of $\frac{5}{6}$ of $\frac{7}{2}$ of 4, to a single fraction.

1042. Multiply 4 ft. 7 in. by 6 ft. 4 in.

1043. Reduce $\frac{3}{7}$ of a pole to the fraction of an acre.

1044. Find the difference between $\frac{3}{7}$ of $10\frac{1}{2}$, and $\frac{5}{6}$ of 20.

1045. In 600*l.* Canada, how much Irish ?

1046. Find the difference between $\frac{4}{5}$ of $\frac{3}{8}$ of 19, and $\frac{1}{2}$ of $\frac{3}{3}$ of $23\frac{3}{10}$.

1047. Reduce $\frac{5}{6}$, $2\frac{3}{5}$, and 4, to a common denominator.

1048. Reduce $\frac{5}{8}$ of a penny sterling to the fraction of an English guinea ?

1049. How many square yds. of carpet will cover a floor 28 ft. by 16 ?

1050. Reduce $\frac{3}{11}$ of a barley corn to the fraction of a mile.

1051. How much in length, that is $7\frac{3}{4}$ inches wide, will make a square foot ?

1052. A line 28 yds. long, will reach from the top of a wall 28 ft. high, standing on the brink of a ditch, to the opposite bank ; how wide is the ditch ?

1053. Reduce $\frac{3}{5}$ of a nail, to the fraction of an ell English.

1054. Reduce $\frac{3}{5}$ of a lb. Troy, to its value.

1055. Multiply ·385746 by ·00464.

1056. Reduce $\frac{4}{27}$ of a grain, to the fraction of a lb. Troy.

1057. In 400*l.* sterling, how much Maryland ?

1058. Reduce $\frac{2}{4}\frac{5}{2}\frac{6}{2}\frac{}{5}$ to its lowest terms.

1059. Tell the square root of $\frac{2}{14}\frac{7}{7}$.

1060. Reduce $\frac{5}{6}$ of a penny ster. to the fraction of a dollar.

1061. Find the difference between $\frac{4}{5}$ of $13\frac{2}{20}$, and $\frac{5}{6}$ of $\frac{1}{2}$ of $\frac{2}{3}$ of $67\frac{5}{20}$.

1062. Reduce $\frac{3}{4}$d. N. York, to the fraction of an English guinea.

1063. Tell the difference between $\frac{3}{6}$ of a lb. avoirdupois, and $\frac{2}{3}\frac{5}{0}$ of an ounce.

1064. Tell the square root of $\frac{9}{12}$.

1065. What is the 4th root of 4096.

1066. Tell the difference between $\frac{3}{5}$*l.* and $\frac{3}{10}$s.

1067. Tell the difference in sterling between $\frac{3}{7}$*l.* sterling, and $\frac{5}{9}$ of a dollar.

1068. What is the value of $\frac{3}{14}$ of a year ?

1069. When 6 persons use $1\frac{1}{2}$ lb. of tea in 2 months, how much will suffice 8 persons $\frac{1}{2}$ a year ?

1070. Reduce $\frac{3}{10}$ of a day to its value.

1071. Find the cube root of the square root of 262144.

1072. Tell the difference between 2714 and ·916.

1073. In 100*l.* Irish, how much Connecticut?

1074. Tell the sum of $276+54{\cdot}321+112+{\cdot}65+12{\cdot}5+{\cdot}0463$.

1075. Reduce $\frac{5}{8}$ of a crown to the fraction of an English guinea.

1076. Divide 234·70525 by 64·25.

1077. In 100*l.* Irish, how much Georgia?

1078. Reduce $\frac{5}{6}$ of $\frac{1}{2}$ crown to the fraction of an English shilling.

1079. Tell the difference between $\frac{4}{5}$ of 2s. 6d. & $\frac{6}{7}$ of 5s. 8d.

1080. Divide 14 by ·7854.

1081. In 100*l.* Irish, how much sterling?

1082. How many feet is the side of a square containing $\frac{1}{2}\frac{6}{8}\frac{2}{8}$ of a square mile?

1083. Reduce 3 ft. 8 in. to the fraction of a mile.

1084. Reduce $\frac{3}{5}$ of $\frac{1}{2}$ of $\frac{2}{3}$, & $3\frac{1}{3}$, to a common denominator.

1085. Divide 5·16 by 1000.

1086. Reduce 3 qt. $1\frac{1}{2}$ pt. to the fraction of a hhd.

1087. Tell the difference, in federal money, between $\frac{3}{8}$ of a guilder, and $\frac{3}{7}$ of $3\frac{1}{2}$ livres.

1088. Tell the difference, in federal money, between 2*l.* 11s. N. England, and $\frac{2}{3}$ of $\frac{3}{8}$ of $10\frac{3}{5}$ dolls.

1089. If 2 ships sail from the same port, one north 76 leagues, the other east 58 leagues; how far are they asunder?

1090. Reduce 4 lb. 3 oz. 6 dr. to the fraction of a Cwt.

1091. Divide 6 by ·6.

1092. Tell the value of ·3375 of an acre.

1093. Reduce 3s. $5\frac{1}{2}$d. ster. to the fraction of a guinea.

1094. In 400 livres, how much Nova-Scotia?

1095. Add $\frac{1}{4}$*l.* $\frac{2}{9}$s. and $\frac{5}{12}$d.

1096. Add $\frac{3}{5}$, $\frac{5}{6}$, $\frac{1}{2}$, and $\frac{2}{3}$ of $\frac{4}{5}$ of 5.

1097. Reduce $\frac{2\,7\,5}{3\,8\,4\,2}$ to a decimal.

1098. In 400 livres, how much Irish?

1099. Tell the difference between $5\frac{3}{8}$, and $\frac{2}{7}$ of $4\frac{1}{6}$.

1100. Tell the difference between $\frac{2}{9}$ of $\frac{2}{3}$ of 7 Cwt. 3 qr. 12 lb., and $\frac{3}{4}$ of $\frac{1}{2}$ of $\frac{9}{1\,0}$ of 5 Cwt. 3 qr. 27 lb.

1101. Tell the difference between $\frac{5}{9}$*l.* and $\frac{2}{3}$ of $\frac{3}{4}$s.

1102. Reduce ·6875 yd. to its value.

1103. If a ship of 500 tons has 80 feet keel, what must be the keel of another of the same shape, to carry 250 tons?

1104. Add $7\frac{2}{5}$ of $\frac{4}{7}$, and $\frac{3}{5}$ of $\frac{4}{7}$ of 7. and $5\frac{2}{3}$, and $\frac{9}{11}$.

1105. Find the side of a cubical box containing 12 bushels.

1106. Add $\frac{3}{4}$s. and $\frac{5}{9}$*l.*

1107. Add $\frac{4}{9}$ of a farthing, and $\frac{3}{11}$ of a shilling.

1108. Tell the difference between $\frac{2}{7}$ of $5\frac{1}{6}l.$, and $\frac{3}{5}$s.

1109. In 600 guilders, how much Canada?

1110. Add $\frac{5}{6}$ dwt. and $\frac{3}{10}$ lb. Troy.

1111. What cost 564, at 6*l.* 13s. 4d. each?

1112. Add $\frac{3}{7}l.$ $\frac{3}{5}$s. and $\frac{3}{4}$q.

1113. Tell the difference, in sterling, between $\frac{8}{10}$ of $\frac{10}{11}$ of 5 Eng. guineas, and $\frac{2}{3}$ of $\frac{4}{7}$ of $\frac{7}{8}$ of $\frac{6}{7}$ of 20 crowns.

1114. If a globe of silver, 5 inches in diameter, is worth 465 dolls., what is the value of one 2 feet in diameter?

1115. Reduce ·056 of a pole to the decimal of an acre.

1116. In 600 guilders, how much Irish?

1117. Multiply $\frac{2}{3}$, $3\frac{1}{4}$, 5, and $\frac{3}{4}$ of $\frac{3}{5}$, continually together.

1118. Reduce ·21 pt. to the decimal of a peck.

1119. Add $\frac{2}{3}$ of a year, $\frac{3}{4}$ of a day, and $\frac{4}{5}$ of an hour.

1120. Reduce 14 minutes to the decimal of a day.

1121. Multiply $\frac{7}{9}$, $\frac{3}{5}$, and $4\frac{5}{14}$, continually together.

1122. Add $\frac{5}{6}$ of a crown to $\frac{3}{8}$ of a dollar.

1123. Add $\frac{3}{9}$ hhd. and $\frac{5}{8}$ gal.

1124. Multiply $\frac{5}{6}$ by $\frac{2}{3}$ of $\frac{6}{7}$.

1125. Divide $\frac{2}{3}$ of $\frac{1}{3}$ by $\frac{5}{7}$ of $7\frac{3}{5}$.

1126. Add $\frac{6}{7}l.$ ster. to $\frac{6}{7}$ of an Eng. guinea.

1127. Add $\frac{3}{5}l.$ sterling, $\frac{3}{4}$ of an Eng. guinea, $\frac{3}{4}$ of a crown, and $\frac{3}{4}$ of a dollar.

1128. What cost 12 Cwt. 2qr. 14lb. at 7*l.* 10 s. 9d. per Cwt.?

1129. Reduce $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{1}{2}$ of 10, to a single fraction.

1130. In $5\frac{3}{5}$s N. York, $5\frac{3}{5}$s. Vermont, $5\frac{3}{5}$s. N. Jersey, $5\frac{3}{5}$s. Georgia, $5\frac{3}{5}$s. sterling, and $5\frac{3}{5}$ dolls., how many dollars?

1131. Tell the difference between $\frac{5}{9}$ of $\frac{6}{11}$ of 10 inches, and $\frac{1}{3}$ of $\frac{3}{4}$ of $\frac{9}{10}$ of 5 feet.

1132. What cost 9 Cwt. 2 qr. 26 lb. at 7*l.* 10s. 9d. per Cwt.?

1133. Reduce $\frac{1}{2}$ of $\frac{3}{5}$ of $\frac{5}{6}$ of $\frac{3}{4}$ of 7, to a single fraction.

1134. In $\frac{5}{8}l.$ ster., 2·31s. Vermont, and $\$5\frac{1}{2}$, how many dollars?

1135. Reduce $\frac{3}{7}$ of $\frac{2}{3}$ of $\frac{1}{2}$ of $7\frac{1}{2}$, to a single fraction.

1136. Add $1{\cdot}234l.$ and $\frac{3}{5}$s. and $\frac{5}{9}$ of a farthing.

1137. If a board is ·75 of a foot wide, what length of it will make 24 square feet?

1138. Tell the difference between $\frac{3}{4}$ of $\frac{6}{7}$ of 21 hhds., and 3·789 gallons.

1139. A cubical stone contains 42875 solid inches; what is the superficial content of one of its sides?

1140. At 4*l.* 17s. per Cwt. what cost 17 lb.?

1141. Reduce $\frac{5}{7}$ of a Cwt. to the fraction of an ounce.

1142. Tell the difference between $\frac{3}{7}$ of 4·689 yds., and $\frac{8}{16}$ of $\frac{5}{6}$ of 23·67 nails.

1143. Multiply 5, $\frac{2}{5}$, $\frac{2}{7}$ of $\frac{3}{5}$, and $4\frac{1}{6}$, continually together.

1144. Multiply $\frac{5}{3}$ of $\frac{4}{5}$ of $11\frac{3}{16}$, by $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{8}{7}$ of 20.

1145. Multiply 23·678 by $\frac{3}{3}$ of $\frac{5}{7}$ of $\frac{5}{3}$ of $15\frac{3}{7}$.

1146. Multiply $\frac{2}{5}$ of 3*l.* 15s. 6d. by $\frac{2}{7}$ of $\frac{3}{8}$ of $19\frac{2}{3}$.

1147. What cost 3 hhd. tobacco, each 4 Cwt. 2 qr. 7·4 lb., at 8s. 2·3d. for 4·2 lb.?

1148. A person, after spending $\frac{1}{2}$, and $\frac{1}{3}$, and $\frac{1}{16}$ of his money, has 160 dolls. left; how much had he at first?

1149. Multiply $\frac{2}{3}$ of $\frac{3}{5}$ of $\frac{7}{8}$ of 15 dolls. by 3·7689.

1150. Suppose 300 stones were laid 2 yds. from each other in a line, and a basket was placed 4 yds. from the first; how far must a person travel, to gather them one by one into the basket?

1151. Multiply $\frac{3}{7}$ of 5 crowns by 3·6789, and tell the amount in sterling.

1152. A person, after spending $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of his money, and $\frac{1}{3}$ of $\frac{3}{4}$ of $\frac{2}{3}$ of the remainder, has 350 dolls. left; what had he at first?

1153. Multiply $\frac{2}{3}$ of $\frac{1}{2}$ of $\frac{3}{7}$ of 5 Cwt. 3 qr. 26 lb. by 13·6.

1154. Sold 16 yds. of cloth, the first for 5s., and the last for 3*l.* 5s., in arithmetical progression; what was the common difference?

1155. Multiply $\frac{9}{10}$ of 3*l.* 10s. 6d. by $\frac{3}{7}$ of $\frac{4}{5}$ of 26·78.

1156. What number is that, of which $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{1}{2}$, and $\frac{1}{3}$ of $\frac{1}{2}$ of $\frac{1}{6}$, amount to 200?

1157. Divide 200 dolls so that A shall have twice as much as B, and 6 dolls. more; and C 3 dolls. more than A: what is each man's share?

1158. Tell the amount of an annuity of 350 dolls. for 4 years, at $5\frac{1}{2}$ per cent, compound interest.

1159. Multiply $\frac{2}{3}$ of $\frac{9}{10}$ of 35 guineas by $\frac{2}{3}$ of $\frac{3}{4}$ of 21, and tell the amount in sterling.

1160. A person being asked his age, said, if $\frac{1}{3}$ of $\frac{2}{5}$ of $\frac{3}{5}$ of the years I have lived, be multiplied by 12, and the product divided by 6, the quotient will be 20; how old was he?

1161. Find the content of a triangle, whose sides are all equal, and together measure 90 chains.

1162. Sold 25 yds. at 4d. for the first, 8d. for the second, 1s. for the third, and so on; what was the last?

1163. Bought 25 yds. at 4d. for the first, 8d. for the second, 16d. for the third, and so on; what was the last?

1164. Find the side of a cubical box containing 17 bushels.

1165. A son asking his father how old he was, received for answer, your age is now $\frac{1}{3}$ of mine, but 9 years ago it was $\frac{1}{6}$ of mine; how old was the father?

1166. Divide $\frac{2}{3}$ of $\frac{1}{3}$ of $\frac{3}{10}$ of 5 Cwt. by $\frac{3}{5}$ of $\frac{1}{4}$ of $28\frac{9}{10}$.

1167. A stationer sold quills at 15s. a thousand, by which he cleared $\frac{1}{5}$ of that money; afterwards he raised them to 18s. a thousand: what did he gain per cent by the latter price?

1168. Divide $\frac{1}{2}$ of $\frac{3}{10}$ of $\frac{9}{13}$ of 50 acres, by $\frac{3}{4}$ of $\frac{5}{6}$ of 37·23.

1169. Of 150*l.* expenses, A paid 10*l.* more than B, and C paid half as much as A and B both, and 15*l.* more; what sum was paid by each?

1170. Tell the present worth of an annuity of 50*l.* to continue 4 years, discount at 4 per cent compound interest.

1171. If the base of a cylindrical vessel is 5 feet in diameter, how high must it be, to contain 50 bushels?

1172. If a square contains 250 acres, how long is one side of it?

1173. If the earth were a perfect sphere, and its circumference 25000 miles, how many square miles would its surface be?

1174. How many cubic miles would it contain?

1175. Divide ·375 of $\frac{3}{77}$ of 37·25 lbs. Troy, by $\frac{3}{7}$ of 1·23.

1176. How many different numbers of ten figures in each, can be expressed by our ten numeral characters, without having the same character twice in the same number?

1177. If 2·37*l.* ster. pay for 21 bushels, how many can be purchased for $\frac{2}{3}$ of $\frac{4}{5}$ of 24·67 guilders?

1178. If a cask, the head diameter of which is 27 inches, contains 118 gallons, what must be the head diameter of another of the same shape, to contain 63 gallons?

1179. The head of a fish is 12 inches long, and its tail is half the length of the head and body both, and the body is 6 inches longer than the head and tail both; what is its whole length?

1180. How many different dozens can be chosen out of 24 individuals?

1181. Find the area of a triangle, the sides of which measure 25 chains, 36 ch. and 41 ch.

1182. If $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{9}{10}$ of $36\frac{3}{7}$ English guineas pay for $\frac{1}{3}$ of $\frac{2}{5}$ of 334·567 yds., how much will $\frac{3}{10}$ of $\frac{1}{2}$ of $\frac{4}{7}$ of $4567\frac{2}{3}\frac{5}{7}$ yres pay for?

1183. How many different companies, of 5 persons each, can be chosen out of 25 individuals?

1184. Find the height of a cylindrical vessel, whose diameter is 10 feet, to contain 100 bushels.

1185. Tell the amount of 176*l.* for 4 years, at 5 per cent, compound interest.

1186. What must I give for a perpetuity of 500 dollars, discounting at $5\frac{1}{2}$ per cent compound interest?

1187. If $\frac{9}{11}$ of $\frac{3}{5}$ of $\frac{1}{2}$ of 5 yds. cost $567\frac{2}{25}$ rubles, how many dollars will pay for $23\frac{14}{17}$ yds.?

1188. Tell the compound interest of 235*l.* for 5 years, at 4 per cent.

1189. A person owned $\frac{3}{7}$ of a ship, and sold $\frac{3}{5}$ of his share for 976*l.*; what was the value of the ship?

1190. Bought goods for 375 dollars, and sold them in 4 months for 476 dolls.; how much per cent per annum was gained?

1191. If $\frac{2}{5}$ of $\frac{6}{7}$ of 375·63*l.* pay for $\frac{3}{7}$ of $\frac{1}{2}$ of $\frac{9}{10}$ of $3456\frac{1}{9}$ acres, what cost $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{4}{5}$ of 376·78 acres?

1192. Tell the area of a circle, whose diameter is 15 rods.

1193. Bought goods for 250 dolls. ready money, and sold them for 345 dolls. payable in 10 months; what was the gain per cent in ready money, supposing the discount to be 6 per cent?

1194. Bought 35 yds. of cloth for 12*l.* 5s., of which part was velvet, at 9s. per yd., and the rest linen, at 4s. per yd.; how many yards of each?

1195. What perpetuity can be purchased for 200 dollars, discounting at 5 per cent compound interest?

1196. Tell the breadth of a river, according to Problem 7, of Mensuration, when EF is 26 rods, FD 40 rods, and EC 280 rods?

1197. Tell the area of a circle whose diameter is 25 chains.

1198. Find the solid content of a pyramid, the base of which is a triangle having each side 30 feet, and the perpendicular height being 50 feet.

1199. If 2 doz. apples, of equal size, are put into a peck measure, and 3 wine pints of sand just fill it, how many solid inches does each apple contain?

1200. A person being asked the hour of the day, said, the time past noon is equal to $\frac{3}{4}$ of the time till midnight; what time was it?

1201. What principal, at 5 per cent compound interest, will amount to 520*l.* 18s. $7\frac{1}{2}$d. in 3 years?

1202. If the wall of a fortress is 16 feet high, and is surrounded by a ditch 20 feet broad, how long must a ladder be, to reach from the outside of the ditch to the top of the wall?

1203. Reduce 15*s.* 6*d.* to the decimal of a pound.

1204. Tell the difference between $\frac{1}{3}$ of $\frac{3}{7}$ of $\frac{4}{9}$ of 16 yds. and $\frac{3}{4}$ of $\frac{4}{11}$ of $4\frac{1}{2}$ rods.

1205. If a ladder, 80 feet long, be so placed as to reach a window 40 feet from the ground, on one side of the street, and without being moved at the foot, will reach a window 22 feet high on the other side, how wide is the street?

1206. If 100 apples were placed in a straight line, 6 feet apart, and a basket placed 6 feet from the first, how far must a person travel, to gather them one by one into the basket?

1207. A merchant sold 150 *yds.* of cloth, at 1*s.* for the first *yd.* 3*s.* for the second, 5*s.* for the third, and so on; what did he gain or lose, if he gave 3*l.* per *yd.*

1208. If 9·5 yds. cost $25·75, what cost 435·5 yds?

1209. Bought 54 yds. the first at 2 dollars, and the last at 161 dollars, in arithmetical progression; what was the common difference?

1210. Tell the present worth of an annuity of $50 dolls. to continue 6 years, at 7 per cent, simple interest.

1211. Find the area of a triangular field, of which one side measures 43 poles, and the perpendicular upon it 15 poles

1212. What is the content of a triangle, whose sides are all equal, and measure 34 rods each?

1213. If a stick of round timber, whose diameter at the butt is 25 inches, contains 100 solid feet, what must be the butt diameter of a similar stick, to contain 68 feet?

1214. How many days can 6 persons seat themselves differently at dinner?

1215. If a triangle whose base is 27 chains, contains 35 acres, what will another of the same shape contain, whose base is 50 chains?

1216. Mixed 10 bush. wheat, at $1·25 a bushel, 12 bush. rye at 70 cents, 15 bush corn, at 60 cents, 20 bush. barley, at 40 cents, and 30 bush. oats, at 30 cents: what is a bushel of the mixture worth?

1217. Find the content of a four sided field, which being divided into two triangles by a diagonal line, that line measures 41 chains, and the perpendiculars upon it from the opposite angles 25 chains and 19 chains.

1218. Find the content of a field, which being divided in-

to 6 triangles, the sides and perpendiculars upon them measure as follows:

Triangles.	*Bases.*	*Perp.*	*Triangles.*	*Bases.*	*Perp.*
No. 1,	34 rods,	19 rods.	No. 4,	43 rods,	25 rods.
2,	25	15	5,	49	33
3,	35	22	6,	50	34

1219. Mixed the following quantities of sugar, worth the following prices per cwt. to wit: 2 cwt. at 9 dolls. 4 cwt. at 10 dolls. 5 cwt. at 12 dolls. and 6 cwt. at 14 dolls. what is 3 cwt. of the mixture worth?

1220. Find the length of a slanting tree, when if you set up a pole parallel to the tree, 18 feet long from the ground, and take such a station that your eye is in range with the top of the pole and the top of the tree, and also in a range with a mark on the pole and another on the tree, each 5 feet from the ground, your station is 12 feet from the pole, and 55 from the tree.

1221. If 20 oz. of gold, at 5*l.* per oz. 12 lb. of silver, at 3*l.* 10*s.* per lb. and 50 lb. of copper, at 5*s* per lb. be mixed, together; what is 20 lb. of the mixture worth?

1222. Find the present worth of a perpetuity of 800 dolls. per annum, discounting at 4 per cent, compound interest.

1223. How long must be the side of a cubical box, to contain 20 bushels?

1224. Tell the compound interest of 347 dolls for 4 years, at 5 per cent.

1225. Tell the number of solid feet in a stick of squared timber which is 16 by 18 inches in diameter throughout, and 65 feet long.

1226. What principal, at 5 per cent compound interest, will amount to 643*l.* 5*s.* 1·1778*d.* in 6 years?

1227. Find the area of a circle whose circumference is 340 rods.

1228. What must be given for a perpetuity of 250 dolls. to commence in 6 years, discount at $5\frac{1}{2}$ per cent, compound interest?

1229. In what time will 600 dolls. amount to $714·6096, at 6 per cent, compound interest?

1230. With 15 gals brandy, at 14s. a gal. I mixed 14 gals. of whiskey at 5s. and 10 gals of water at 0; at what rate per gal. must I sell it to gain 12 per cent?

1231. A man has a square garden, one side of which measures 25 rods, and a circular fish pond in the center, the diameter of which is 9 rods; how much ground has he?

1232. How much gold, at 4*l.* per oz. and silver, at 12*s.*

per oz. must be mixed with 20 lb. of copper at 6s. per lb. that 50 lb of the mixture may be worth £240?

1233. Find the solid content of a pyramid whose base is an equilateral triangle, the circumference of which is 33 feet, and the perpendicular height 40 feet.

1234. Which is the most valuable, and how much so, an annuity of $300 for 6 years, or a perpetuity of $300 to commence after 6 years, discount at 5 per cent compound interest?

1235. At what rate per cent, compound interest, will 231£ amount to 249£ 16s. 1d 904*d.* in 2 years?

1236. If a pyramid, whose perpendicular height is 15 feet, contains 192 solid feet, what must be the height of another of the same shape, to contain half as much?

1237. If the diameter of one circle is 27 rods, what must be the diameter of another to contain $\frac{1}{3}$ as much ground?

1238. Twenty-two persons bestowed charity on a beggar; the first gave 5*d.* the second 6*d.* the third, 7*d.* and so on; what did the last one give?

1239. Two families set out, at 9 o'clock in the forenoon, each in their own carriage, to go to a place 20 miles distant. The first travels at the rate of 6 miles an hour, and the other at the rate of 5 miles an hour. At the half way house, the first stops 15 minutes, and then goes on to the end. The second stops 15 minutes at the end of 8 miles, and then goes on. When the first gets through, it stops 20 minutes, and the other not coming, the empty carriage goes back at the rate of 8 miles an hour. The second carriage breaks down at the end of 12 miles, and after a delay of 15 minutes, the party walk forward at the rate of 4 miles an hour. The first carriage meets them, and takes them up, and proceeds with them at the rate of 6 miles an hour, to the end. At what o'clock does the second family reach the place of destination?

1240 If a cone 15 feet high, contains 100 solid feet, how far from the base must it be cut, to divide it into two equal parts?

1241. Tell the difference between $\frac{5}{6}$ of $\frac{3}{8}$ of $19\frac{3}{8}$ acres, and $\frac{4}{7}$ of $\frac{3}{5}$ of $168\frac{3}{10}$ poles.

1242. Multiply $\frac{3}{4}$ of $\frac{1}{2}$ of $\frac{3}{8}$ of $\frac{6}{7}$ of 25£ 16s. by 3·98.

1243. Divide $\frac{3}{5}$ of $\frac{4}{7}$ of 21, by $\frac{3}{8}$ of $\frac{9}{10}$ of $3\frac{3}{4}$.

1244. If $\frac{3}{5}$ of $\frac{9}{10}$ of 8 pay for $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{9}{10}$ of 100 acres, how much can be bought for $\frac{3}{5}$ of $\frac{5}{7}$ of 123·45*l.* N. Scotia?

1245. If $\frac{3}{10}$ of 25 Eng. guineas pay for $\frac{1}{2}$ of $\frac{3}{5}$ of $\frac{5}{7}$ of 556·34 yds., what will $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{3}{7}$ of 325£ 13s. 6d. N. York, pay for?

1246. If $\frac{2}{3}$ of $\frac{1}{2}$ of $\frac{3}{5}$ of 235 guilders pay for $\frac{1}{2}$ of $\frac{3}{7}$ of $\frac{1}{9}$ of $396\frac{11}{13}$ yds., how many dolls. will pay for $\frac{3}{7}$ of $\frac{9}{10}$ of $\frac{4}{5}$ of of 23·678 yds.?

1247. If $\frac{2}{3}$ of $\frac{1}{2}$ of 3 lb. of tea, serve 9 persons $\frac{3}{8}$ of $\frac{1}{2}$ of $3\frac{1}{2}$ months, how many persons will $\frac{3}{4}$ of $\frac{1}{3}$ of $\frac{3}{7}$ of $10\frac{1}{3}$ lb. serve $\frac{1}{2}$ of $\frac{3}{4}$ of 15 months?

1248. If 34·56*L* ster. be the interest of 356 Eng. guineas, for $\frac{1}{2}$ of $\frac{2}{3}$ of 345·67 days, how much sterling will be the interest of $3867\frac{7}{8}$ dolls. for $\frac{1}{3}$ of $\frac{4}{5}$ of $\frac{6}{7}$ of $234\frac{2}{3}\frac{6}{7}$ days?

1249. Divide $\frac{4}{3}\frac{6}{6}\frac{}{1}$ by $\frac{1}{2}$ of $\frac{5}{6}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{3}{2}\frac{4}{5}$, and tell the difference between the square and cube of the quotient.

1250. If the walls of the temple of Solomon, had been 3 feet thick when finished, and one inch of the outside and one inch of the inside had been fine gold, how many talents would it have required, allowing one foot high on the inside to have been occupied by the floor? (See No. 399.)

1251. Ascending bodies are retarded in the same ratio that descending bodies are accelerated; therefore, if a ball discharged from a gun perpendicularly into the air, returned to the earth in 10 seconds, how high did it ascend?

1252. Find the number of solid feet in a load of wood, which is 4 ft. 6 in. high, 3 ft. 10 in. wide, and 9 ft. 4 in. long.

1253. A laborer was hired for 50 days, upon condition that for every day he labored he should receive 8s., and for every day he was idle he should forfeit 3s. At the end of the time, he received 9*l*. 11s.; how many days did he labor?

1254. Tell the area of a circle whose radius is 14 chains.

1255. Find the difference in the depth of two wells, into which a bullet let fall, reaches the bottom in 4 seconds and 6 seconds respectively.

1256. If $\frac{3}{4}$ of $\frac{1}{2}$ of $\frac{1}{3}$ of $10\frac{1}{2}$ lb. of tea serve 5 persons $3\frac{1}{2}$ months, how much will serve 7 persons $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of $6\frac{3}{7}$ mo.?

1257. Tell the area of a circle whose circumference is 25 chains.

1258. What must be paid for a perpetuity of 100 dollars, to commence in 4 years, discount at $4\frac{1}{2}$ per cent compound interest?

1259. If a man travels 34·56 miles in $4\frac{3}{4}$ days, when the days are $13\frac{5}{6}$ hours long; how far can he travel in 10·45 days, when they are 15·57 hours long?

1260. Tell the difference between 30 square rods, and 30 rods square.

1261. In what time will 200*l.* amount to 231*l.* 10s. 6d. at 5 per cent compound interest?

1262. Tell the superficial content of a pyramid, the base of which is an equilateral triangle, each side measuring 13 feet, and the slant height 35 feet.

1263. Find the solid content of a cone, the diameter of whose base is 17 feet, and the perpendicular height 35 feet.

1264. What is the circumference of a circle, whose diameter is 36 rods?

1265. Multiply $\frac{1}{2}$ of $\frac{3}{4}$ of the square of 45, by $\frac{2}{3}$ of $\frac{1}{2}$ of the square root of 144.

1266. What number is that, which being multiplied by 18, and the product divided by 12, the quotient is 300?

1267. Add $\frac{8}{9}$ of $\frac{3}{7}$ of the square of $\frac{2\,3\,4}{2\,3\,5}$, to $\frac{3}{7}$ of $\frac{1}{8}$ of $\frac{5}{9}$ of the square root of $\frac{5\,2\,9}{1\,9\,3\,6}$.

1268. What number is that, which being increased by $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{3}$ of $\frac{1}{6}$ of itself, and the sum divided by 20, the quotient will be 77?

1269. Add the square of $\frac{1\,9}{2\,0}$ to the cube of $\frac{2\,1}{2\,2}$, and tell what is $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{5}{6}$ of the sum.

1270. Tell the solid content of a cone, the circumference of whose base is 45 feet, and its perpendicular height 34 feet.

1271. Find the difference between the simple interest of 375 dolls. for 6 years, at 7 per cent, and the discount of the same sum, at the same rate and time.

1272. Add the cube of $\frac{3\,3}{5\,1}$ to the square of $\frac{8\,8}{9\,9}$, and tell what is $\frac{3}{5}$ of $\frac{1}{3}$ of its square root.

1273. Which is the most valuable, and how much so, an annuity of 500 dolls. for 8 years, or a perpetuity of 500 dolls. to commence after 8 years, discounting at 6 per cent compound interest?

1274. From $\frac{9\,0\,0}{2\,5}$ take $\frac{1}{3}$ of $\frac{1}{2}$ of itself, and tell what is the sum of the square and cube of the remainder.

1275. At what rate per cent, compound interest, will 200 dolls. amount to $252·495392, in 4 years?

1276. A man sold $\frac{1}{5}$ of his sheep, and 12 more, at one time; and at another, $\frac{1}{3}$ of the remainder, and 15 more, and had 137 left; how many had he at first?

1277. Find the content of a circular ring 2 rods broad, round a circular fish pond of 3 acres?

1278. A person who owned $\frac{3}{5}$ of a ship, sold $\frac{2}{7}$ of his share for 500 dolls.; what was the ship worth?

1279. In an orchard, $\frac{1}{2}$ are apple trees, $\frac{1}{4}$ pear trees, $\frac{1}{8}$ cherry trees, $\frac{1}{9}$ peach trees, and 10 plum trees; how many trees in all?

1280. What is the content of a circular ring 3 rods broad, the inner circumference of which measures 346 rods?

1281. If $\frac{1}{3}$ of $\frac{1}{5}$ of $\frac{3}{7}$ of a ship is worth $\frac{1}{2}$ of $\frac{2}{7}$ of $\frac{3}{5}$ of $\frac{1}{3}$ of her cargo, that part of the cargo being worth 1200*l*.; what is the value of the ship and cargo together?

1282. Tell the amount of an annuity of 650 dollars, for 7 years, at 6 per cent, simple interest?

1283. A, B, and C, purchased a vessel in company; A paid $\frac{3}{5}$, B $\frac{3}{8}$, and C 100 dolls; what was the whole?

1284. Tell the cube root of $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{4}{5}$ of 8.

1285. Which is the larger, and how much so, a square of 450 rods circumference, or a circle of the same circumference?

1286. What sum of money will produce as much interest in $4\frac{1}{4}$ years, as 345 dolls. would in $7\frac{1}{3}$ years?

1287. Tell the cube root of $\frac{3}{7}$ of $\frac{1}{2}$ of $\frac{3}{5}$ of 21.

1288. What part of 2s. 6d. is $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{5}$ of 1s. 6d.?

1289. If a cone whose slant height is 20 feet, contains 216 solid feet, how far from the base on the slant height, must it be cut, by a section parallel to the base, to be divided into two equal parts?

1290. Find the cube root of the sum of the square roots of 529 and 1936.

1291. What number is that, from which, if $\frac{2}{3}$ of $\frac{1}{2}$ is taken, the remainder is $\frac{1}{3}$ of $\frac{3}{5}$?

1292. Tell the superficial content of a globe which is 3 feet in diameter.

1293. Tell the cube root of the difference of the square roots of 3136 and 5776.

1294. What number is that, to which, if $\frac{2}{3}$ of $\frac{3}{7}$ of $\frac{125}{6}$ be added, the sum will be 1?

1295. What number is that, which being multiplied by $\frac{2}{3}$ of $\frac{3}{5}$ of 2, the product will be 1?

1296. A, B, and C, bought a ship, which cost 2500 dolls. B paid 100 dolls. more than A; and C, 100 dolls. more than A and B both. They furnished a cargo which cost 250 dolls. less than twice the value of the ship; and the expense of fitting out the vessel was $\frac{1}{5}$ of $\frac{4}{7}$ of $\frac{3}{8}$ of $\frac{9}{10}$ of the value of both

ship and cargo. The profits of the voyage were 25 per cent on the whole, which were to be shared according to the interest of each in the ship: what was A's share of the gain?

1297. A man received for his wages, one grain of wheat for the first day, 4 for the second, 16 for the third, and so on; what is the amount of 30 days' labor, if the wheat is worth 1 doll. a bushel, and 7680 grains of wheat make a pint?

1298. What number is that, from one half of the square of which, if $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{6}$, and $\frac{6}{7}$ of the number, and 123 more, be subtracted, the square root of the remainder is 294?

1299. Two merchants, A and B, began trade with the same capital. A was successful, and gained $\frac{3}{4}$ of $\frac{2}{3}$ of $\frac{1}{2}$ as much as his stock; but B lost $\frac{5}{7}$ of $\frac{5}{8}$ of $\frac{1}{3}$ of 640 dolls. and 20 dolls. more; and then their capitals were in the proportion of 5 to 3: what capital did each begin with?

1300. A, B, and C, joined stock in trade, and made up a capital of ten thousand dollars. B furnished 325 dolls. more than A; and C, 600 dolls. less than A and B together. At the end of 6 months, A took out his stock; and at the end of 10 months, B took out his. At the year's end, the gain was a sum equal to $\frac{2}{5}$ of $\frac{9}{10}$ of $\frac{1}{2}$ of 3 times the stock of C: what was each man's share of the gain?

1301. A and B bought 300 acres of land for 600 dollars, of which they paid equal sums. One part of the lot proving better than the other, A says to B, if you will let me have my choice, your land shall cost you 75 cents an acre less than mine. If B agrees to this proposal, how much land will he have?

1302. I wish to fence a circular piece of ground, with rails which shall be so long as to make 10 feet to each length, and the fence to be 5 rails high, and to have as many acres of ground as I have rails; how many acres will there be?

1303. Suppose the frustum of a right pyramid to be 4 feet square at the base, and one foot square at the top, and the slant height 20 feet; and a rope 2 inches thick, to be wound round it, so as to cover its sides from the bottom to the top; how long is the rope?

1304. A, B, C, and D, purchased a grindstone in company; and the sums they paid respectively, were such that A, B, and C together, paid 3 dolls. 90 cents; A, B, and D together, 1*l*. 13s. 3·36d. N. York cur; B, C, and D together, 1*l*. 1s. 11·52d. N. England cur.; and A, C, and D together, 1*l*. 0s. 3d. sterling. The grindstone was 3 feet in diameter, and 5 inches thick; and there was a hole in the middle, 4

inches in diameter. A is to have it first, and grind off in proportion to the sum he paid; then B, C, and D respectively. I demand the breadth of the circular ring which each is to grind off.

1305. A party of 17 persons wish to go to a place 25 miles distant. They have but one carriage, which will carry 5 persons. At 8 o'clock in the forenoon, the carriage sets out with 5 of the party, and goes on at the rate of 6 miles an hour, till half past 9, when it stops 15 minutes. Finding the roads worse, it then goes at the rate of $5\frac{1}{2}$ miles an hour, till a quarter past 10, and then 5 miles an hour to the end, having made one more stop of 20 minutes. At the end, it stops 18 minutes, and then goes back, with one person to drive, at the rate of 7 miles an hour. The rest of the party set out on foot, 10 minutes after the carriage, and walk at the rate of 4 miles an hour, till a quarter before 10, when they stop 20 minutes. After this, they walk on at the rate of $3\frac{3}{4}$ miles an hour, till half past 10, when they stop 15 minutes. They then walk on at the rate of 3 miles an hour, stopping once more 15 minutes, till they meet the carriage. The carriage takes up 4 of them, and goes on to the end, at the rate of 5 miles an hour. After resting 15 minutes, it goes back again, at the rate of 6 miles an hour. The remaining 8, after resting 20 minutes, walk on at the rate of $2\frac{3}{4}$ miles an hour, till they meet the carriage again. Then the carriage takes up 4 more, and carries them to the end, at the rate of 5 miles an hour, and returns without stopping, at the rate of 6 miles an hour. The remaining 4 walk on at the rate of $2\frac{1}{2}$ miles an hour, till they meet the carriage, and then ride to the end, at the rate of 5 miles an hour. How far does the carriage travel in all, and at what o'clock do the last of the party reach the place of destination?

306. Suppose A, B, and C, can do a piece of work in 165 days; B, C, and D, in 220 days; A, B, and D, in 18 days: A, C, and D, in 198 days: how long will it take each one to do it separately; and how long, if they all work together?

1307. Divide 15 into 2 such parts, that their product shall be $\frac{7484}{1562\frac{5}{8}}$.

1308. If $67\frac{1}{2}$ bushels of oats are sufficient for 12 horses for 4 weeks, and $236\frac{1}{4}$ bushels are sufficient for 21 horses for 9 weeks; how many horses will $627\frac{3}{4}$ bushels suffice for 18 weeks, proceeding in the same ratio?

1309. A and B join in trade, and make up a capital of such a number of dollars, that if it were diminished by $\frac{1}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of itself, and then by $\frac{2}{3}$ of $\frac{3}{5}$ of $\frac{5}{8}$ of the remainder, there would be 648 dolls. left. Their gain was 50 per cent on their capital, and is to be divided in proportion to their shares of the capital. A's share is to be the most, and to be such a sum, that if multiplied by B's, and that product multiplied by the whole capital, and that product divided by $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of the capital, the quotient would be 324000 dols. What is each man's share of the gain?

1310. Six persons, to amuse themselves, threw upon the ground a sum of money, to see how much each could pick up; and the first time, they gathered as follows: A, $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{6}{7}$ of a pound sterling; B, $\frac{3}{4}$ of $\frac{1}{2}$ as much, and $\frac{2}{5}$ of a dollar besides; C, $\frac{1}{2}$ of $\frac{4}{5}$ of $\frac{5}{8}$ as much as B, and $\frac{1}{7}$ of a penny, and $\frac{3}{5}$ of 7 livres besides; D, $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{5}{7}$ as much as C, and 8d. and $\frac{7}{9\,8}$ of a farthing, and $\frac{5}{6}$ of $\frac{7}{8}$ of 4 rubles besides; E, $\frac{4}{5}$ of $\frac{3}{8}$ of $\frac{1}{2}$ as much as D, and $\frac{1}{1\,9\,6}$ of a penny, and $\frac{3}{8}$ of $\frac{5}{9}$ of $5\frac{1}{2}$ crowns besides; and F, the rest, which was $\frac{1}{2}$ of $\frac{3}{5}$ of $\frac{1}{3}$ of $\frac{4}{5}$ as much as E, and $\frac{1}{3}$ of $\frac{3}{4}$ of $\frac{1}{2}$ of $\frac{4}{7}$ of $2\frac{2}{3}$ guilders besides.

Then the money was thrown down again, and the second time they gathered as follows: A, $\frac{1}{2}$ of $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{4}{5}$ of what he had the first time; B, $\frac{2}{3}$ of $\frac{5}{9}$ of $\frac{3}{5}$ of $\frac{1}{2}$ of $\frac{1}{3}$ as much as A; C, $\frac{3}{5}$ of $\frac{1}{2}$ of $\frac{5}{9}$ of 45 times as much as B; D, $\frac{3}{5}$ of $\frac{5}{7}$ of $\frac{1}{12}$ of $\frac{7}{8}$ of $\frac{3}{4}$ of 192 times as much as C; E, $\frac{1}{2}$ of $\frac{7}{10}$ of $\frac{3}{5}$ of $\frac{4}{9}$ of $\frac{6}{7}$ of 25 times as much as D; and F, the rest.

Now, as F had so much the most, he threw down his again; and A got $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{1}{2}$ of $\frac{2}{3}$ of it, and 1 shilling, and $\frac{1\,5\,4\,7}{6\,3\,5\,0\,4}$ of a shilling besides; B, $\frac{2}{5}$ of $\frac{1}{2}$ of $\frac{3}{8}$ of $\frac{1}{3}$ of 12 times as much as A; C, $\frac{2}{7}$ of $\frac{1}{3}$ of $\frac{3}{5}$ of $\frac{3}{8}$ of $\frac{3}{4}$ of 35 times as much as B; D, $\frac{1}{9}$ of $\frac{3}{7}$ of $\frac{7}{9}$ of $\frac{3}{10}$ of 160 times as much as C; F, $\frac{1}{7}$ of $\frac{3}{4}$ of $\frac{1}{2}$ of $\frac{3}{5}$ of 24 times as much as D; and E, the rest.

Then E gave to B $\frac{2}{5}$ of a marc banco, to C 3 livres, and to F half a crown; and A gave to B $\frac{1}{3}$ of a rupee, and to F one rial of plate.

How much, in sterling money, was the sum thrown down; and how much had each person at last?

END OF PART II.

ERRATA.

Page 26, line 3, for 31 read 32.
" 32, " 27 right hand column, insert 9 under 8.
" 43, " 15 after *Ins.* insert D.
" 48, " 35, for 112, 40, read 112, 46
" 49, " 38, for 6 sevenths, read 5 sevenths.
39, for 5 ninths, read 6 ninths
" 60, " 14, for fraction, read fractions.
20, for $9\frac{4}{6}$ read $\frac{4}{9}$
" 68, " 31, read 64 and 13, 11 and 17, 49.
" 70, " 34 right hand column, read 80.
" 79, " 28, for 14 *L.* read 1·4 *L.*
" 95, " 40, for *L*03 read *L*103
" 115, " 18 under 30, read 900
" 134, " 26, for $9461· &c, read $6461· &c.
" 144, " 25, for same, read area.
" 145, " 6, read, 20·921875 acres.
" 149, " 34, for 7496, read 17496.
" 150, " 23 & 24, for 12 & 28, read ·12 & ·28.
" 151, " 27, for 1 162+ read 1·162—
" 154, " 9, read shown, 20
21, read, Clarkson, 150.
40, read, America, 29815000.
" 155, " 13, read year 1799
14, read issued 2967000.
" 156, " 2, read, year 1782.
29, read, *L*18000.
43, read 8758 8.
" 160, " 13, for 2700 read, 27000.
" 168, " 38, read, of 217 3.
41, for *L.* read lb
" 177, " 31, for 22095 read, 220959.
and for 4065119, read 406511.
" 188, " 4, for 1377000 read 2377000.
36, for 252049, read 232049.
" 190, " 6, for were, read was.
" 17, for 30, read 80.
" 25, for 245, read 285
" 42, for 44187, read 44487.
" 205, " 25, for 29, read 19.
" 211, " 33, read 4036658
" 223, " 7, for 335 1-4, read 365 1-4.
" 224, " 31, read 2000.